SmartStorm™

Web-Enabled Irrigation Controller

USERS MANUAL

Revision 1.1

Built-in web server • No subscription services or cloud servers needed

Web Irrigation Applications:

- ***Adjust/control watering at rental properties from an office miles away!***
- ***Remotely delay watering at a city park for a special event!***
- ***Comply with water restrictions without the need to be on location!***

Features Include:

- *Easy-to-use web page setup*
- *10 Programmable zones*
- *Four individual timing programs*
- *Programmable delay between stations*
- *Seasonal water adjustments*
- *Rain and low temperature shutdown*
- *Real-time temperature display*

CONTROL by WEB™
www.ControlByWeb.com

a division of Xytronix Research & Design, Inc.
located in Nibley, Utah, USA

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For SmartStorm model: X-340-A

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X-340 SmartStorm Irrigation Controller User Manual Revisions	
Revision	**Description**
1.0	Initial release
1.1	Fixed input logic for the ON/OFF switch feature.

Section 1: Introduction

The SmartStorm Irrigation Controller™ is a robust, 10-zone irrigation controller with a built-in web server. It can be controlled over any IP network, including the Internet* and private networks. The SmartStorm excels in its web interface which can be accessed from any location by a computer or smart phone using a standard web browser. The web server provides a much larger and more helpful screen than a typical sprinkler controller's small built-in display. The web interface provides colorful graphics, schedule charts, buttons and features unavailable with older sprinkler controllers. The web interface simplifies creating water schedules, sensor monitoring, and manually controlling your irrigation system. These tasks are now user friendly and intuitive. You no longer need to reference the users manual to figure out how to program your irrigation controller each season.

The web interface makes maintenance and repairs easy and efficient. You can isolate broken equipment (sprinkler heads, pipes, valves, etc.) while in the field, without needing a second technician at the controller. You don't need to walk back and forth between the controller and the broken equipment. Simply turn valves on and off using your smartphone.

The web interface allows for instant adjustments to the watering program for weather-related issues, or to make adjustments for dry or over-watered sections.

Technicians or other personnel who do not have direct access to the SmartStorm's web interface can also manually operate the SmartStorm using a single push button on the unit to cycle through each station.

Because water conservation is so important, the SmartStorm includes the ability to control your programming based on rainfall and temperature by connecting appropriate sensors.

The SmartStorm is designed to be extremely reliable! Even if you don't have a constant Internet or network connection, SmartStorm will continue to operate by itself without the need to access remote servers. No paid subscription services and needed. The SmartStorm is easy-to-use whether you are in the yard, inside your home, at work, or on vacation. It is the ultimate solution to your irrigation control needs!

**Note that accessing SmartStorm remotely over the Internet requires the installer to setup your router to forward incoming requests to SmartStorm.*

1.1 Connectors & Indicators

Power and Solenoid Valve Connections

The 14-pin connector located on the bottom of the module provides connections for a 24VAC power source and up to ten solenoid water valves. Zones 9 and 10 can be programmed for a master-valve or pump start relay if needed. There are two common pins for completing the valve wiring circuit.

I/O Connector

A 5-position removable connector provides connections for sensor inputs, manual control inputs, and a temperature sensor

Network Connector

The 10/100 Base-T Ethernet connector on the right side provides communication with a computer, private network, or the internet.

Indicators

Ten yellow LEDs indicate when each zone is energized. The green power LED indicator is illuminated when AC power is present.

Ethernet Indicators

The green LINK LED is illuminated when the module is properly connected to an Ethernet network and is ready to communicate. Network communications will only occur if this LED is illuminated. The ACT LED flashes amber when activity is detected on the network.

Manual Button

Press the manual control button to enter manual control mode. This will cause any zone that is currently activated to be turned off (aborted). The LED indicator of a zone will begin to flash. Press the button again to advance the flashing zone until the desired zone indicator is blinking. When you have selected the desired zone, wait for a moment for the LED to stop blinking and remain illuminated. When the LED is steady, the zone will turn on for 15 minutes.

If you wish to stop the zone mid-cycle you can press the manual control button again to select another zone, or cycle it until no LED indicator lights are blinking to turn all of the zone valves off. Be aware that pressing this button while an automatic watering program is running will abort the program until the next scheduled start time. Note also that if a valve is manually turned on and remains on when an automatic program cycle is scheduled to start, the automatic program cycle will be aborted and will not run until the next scheduled start time.

1.2 Part Numbers and Accessories

Device	Description	Part Number
X-340	Standard SmartStorm Irrigation Controller™ with built-in web server, and ten zones	X-340-A
Temperature Sensor	Digital temperature sensor with 12 inch wire leads ***Note:*** *Leads may be extended* *(for indoor or protected locations only)*	X-DTS-U
Temperature Sensor	Digital temperature sensor with 3 foot wire leads housed in submersible stainless steel probe	X-DTS-S3C
Temperature Sensor	Digital temperature sensor with 32 foot wire leads housed in submersible stainless steel probe	X-DTS-S32C
Power Supply	Wall Transformer 120VAC in, 24VAC out, 12VA *(For installations with one 7VA solenoid valve)*	PS24VWA0.5
Power Supply	Wall Transformer 120VAC in, 24VAC out, 40VA *(For installations with up to two 7VA solenoid valves)*	PS24VWA1.67

Section 2: Installation and Connections

Installation consists of mounting the SmartStorm Irrigation Controller, making wiring connections to a power source, connecting the solenoid valves, connecting the Ethernet network, and configuring via a web browser. Optional rain and temperature sensors can be connected using the 5-position terminal connector.

2.1 Installation Notes

- This unit must be installed by qualified personnel.
- This unit must be installed in a protected enclosure if installed outdoors.
- Mis-wiring could cause permanent damage to the SmartStorm Irrigation Controller, the sprinkler equipment it is connected to, or both.
- Do not connect the SmartStorm directly to a 120VAC line voltage power source, you must use a 24VAC transformer.
- Do not connect a power source to the sensor inputs.

2.2 Mounting

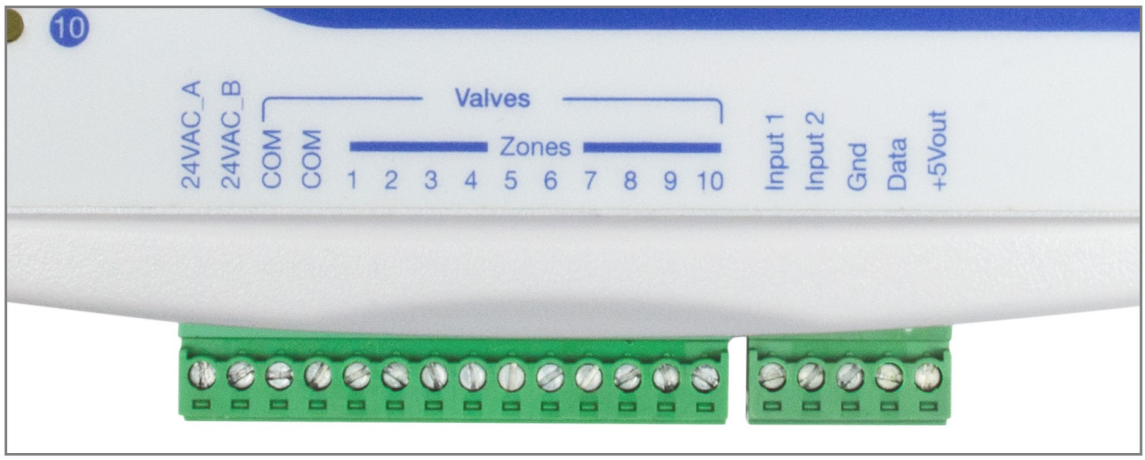
Mount the SmartStorm Irrigation Controller to a wall by using two #8 screws. Hold the module to the wall and use a pencil to mark the location of the holes on the tabs on each side. Attach the screws to the wall, and then hang the module.

See **Appendix J: Mechanical Information** for additional mechanical details.

2.3 Making Connections

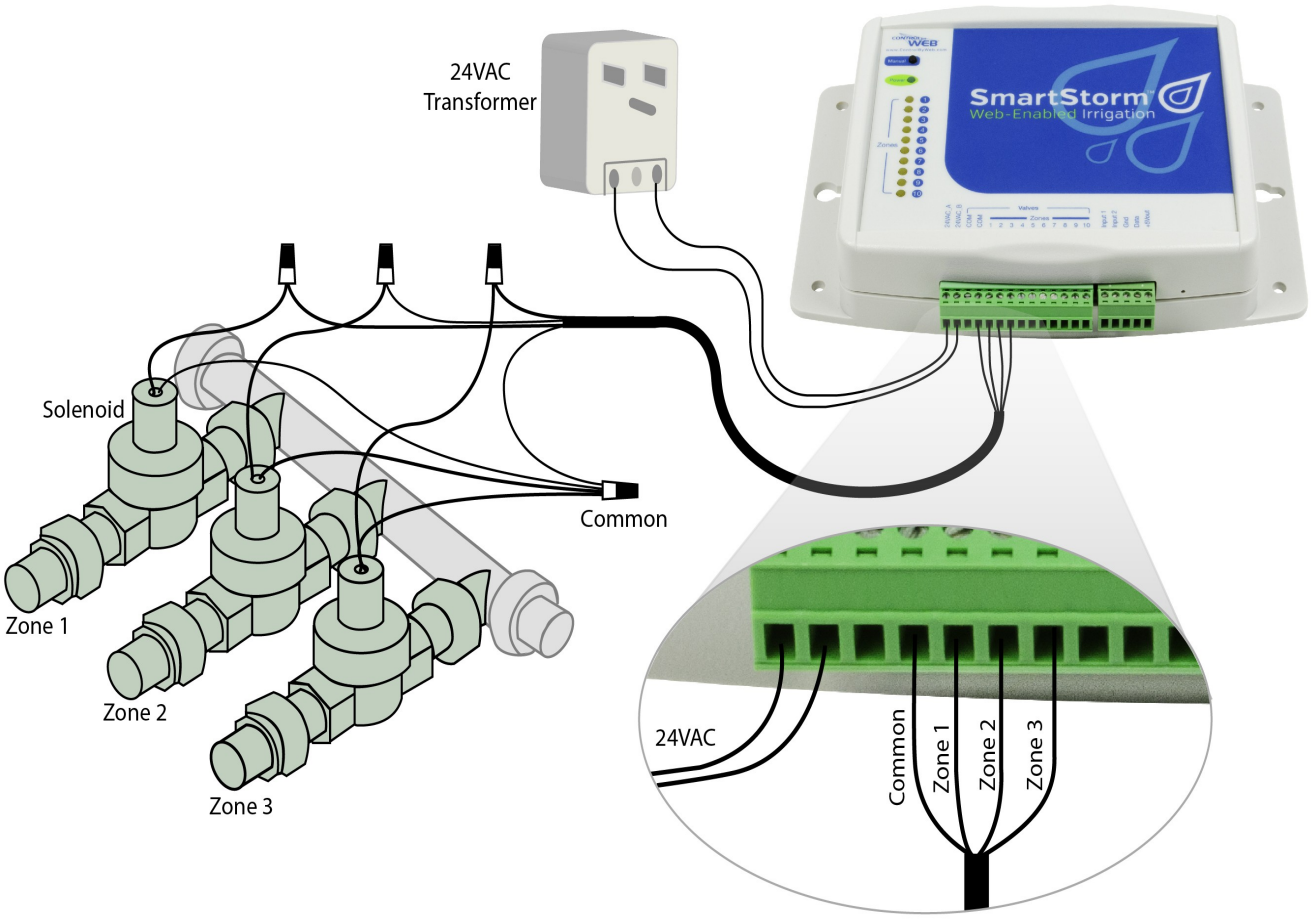
Removable terminal connectors are provided for making connections. The correct wiring procedure is as follows:

1. Make sure power is turned off.
2. Remove the terminal connector from the SmartStorm Irrigation Controller and make wiring connections to the terminals. This technique avoids stressing the internal components while torquing the screws.
3. Reconnect the terminal connector.
4. Apply power.



14-Pin Connector	
Terminal	**Description**
24VAC_A	24VAC Input A
24VAC_B	24VAC Input B
COM	Zone 1-10 COM
COM	Zone 1-10 COM
1	Zone 1
2	Zone 2
3	Zone 3
4	Zone 4
5	Zone 5
6	Zone 6
7	Zone 7
8	Zone 8
9	Zone 9 (or master)
10	Zone 10 (or master)

5-Pin Connector	
Terminal	**Description**
Input 1	Input 1 IN
Input 2	Input 2 IN
Gnd	Ground
Data	Temperature Sensor DATA
+5Vout	Voltage output for Temperature Sensor



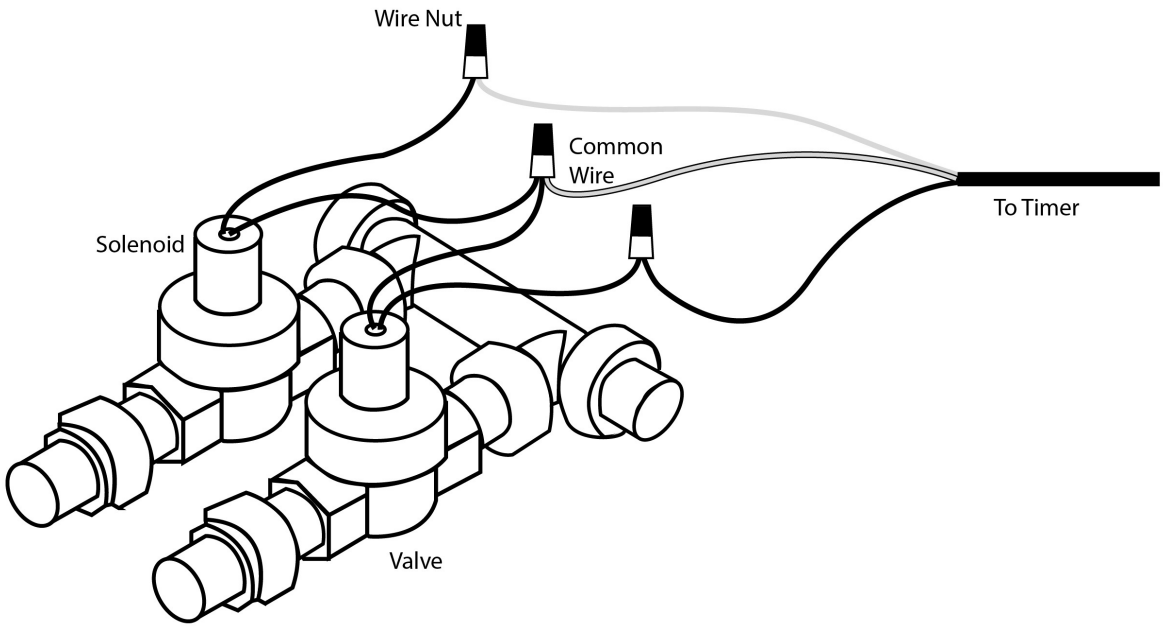
2.3.1 Power Supply

The SmartStorm requires a 24VAC power supply. The power source powers both the SmartStorm and the solenoid valves. Two different 24VAC plug-in transformers are available as accessories. Use the 12VA transformer for installations with one 7VA solenoid valve. Use the larger 40VA transformer for installations with up to two 7VA solenoid valves or one 7VA solenoid valve plus a master valve or pump start relay. The *Advance Settings* tab has a setting for limiting the maximum number of valves that can operate simultaneously. When using the smaller transformer set MaxValves=1 to prevent inadvertent operation of more than one zone (See *Section 4.8 Advanced Settings*).

Connect the transformer to the terminals marked 24VAC_A and 24VAC_B. Do not connect the SmartStorm directly to a 120VAC line voltage power source, you must use a 24VAC transformer.

2.3.2 Solenoid Valve Connections

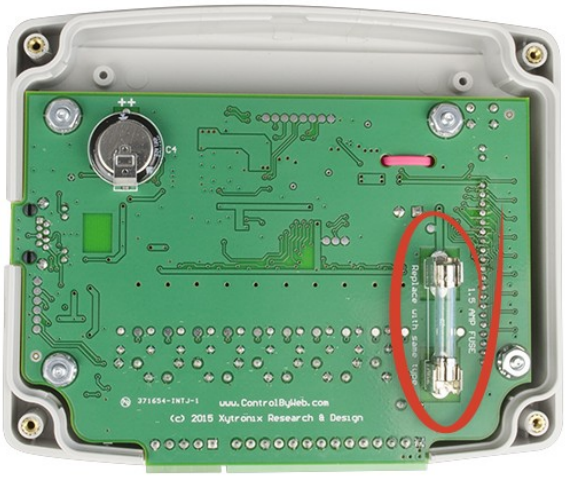
Each solenoid valve requires a separate wire between the valve and one of the Zone terminals on the SmartStorm. The remaining wires from the valves are connected together (the common wire) and wired to one of the *Com* terminals. For the wiring connections in a valve box, either use water tight wire nuts or route the connections near the top of the valve box to avoid allowing the connections to become submerged in standing water. Special wire nuts filled with dielectric gel are available for this purpose. Unprotected submerged connections will become corroded by electrolysis and will eventually fail.



2.3.3 Internal Fuse

The SmartStorm has an internal fuse to protect both itself, the transformer and the solenoid valves. When the SmartStorm is properly powered the green POWER indicator should be illuminated. If the wiring is incorrect or one of the solenoid valves is shorted or defective, the fuse may blow. If the fuse is blown the green POWER indicator will not light. The fuse is user replaceable and can be accessed by removing the four screws on the back side of the enclosure and removing the base shell. To provide continued protection, replace the fuse with one of the same type and rating.

A blown fuse generally indicates that a solenoid valve is faulty or a short exists in the wiring connections. Solenoid valves can become internally shorted if water penetrates the housing and corrodes the internal coil. Before replacing the fuse, check all wiring connections as well as the control valves. If replacing the fuse does not solve the problem, try disconnecting the wire leads to the solenoid valves at the controller to isolate the problem.



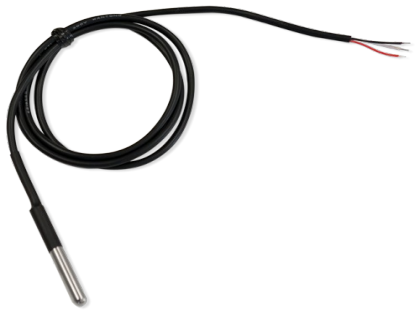
2.3.4 Input Connection

Two discrete inputs can be connected to switches or auxiliary sensors. Third-party sensors can be used for monitoring rainfall and other conditions. The inputs can be programmed to suspend watering or to provide manual control.

Connect one wire of the sensor or switch to a digital input terminal (Input 1 or Input 2). Connect the other wire to the GND terminal. When the contacts are closed the input is connected to GND and the input is considered to be ***ON***. Switch current is less than 2 mA. The inputs use 5Volt logic and work with simple switches and relays. Do not connect the digital inputs to a 24VAC source. The inputs will work with cable lengths up to 50-feet and should not be routed in the same conduit with the solenoid valves or other AC wiring.

2.3.5 Temperature Sensor Connection

A temperature sensor can be used for monitoring environmental conditions. The SmartStorm works with a specific digital temperature sensor which is interchangeable and requires no calibration. The sensors accuracy is +/-0.5°C (-10°C to +85°C). The sensor requires three connections for communications and power (+5V, Ground, Data**).** The temperature sensor is available in two versions. The bare sensor has 12" lead wires and must be used in a protected location. The rugged version is encapsulated in a stainless steel probe and can be used in unprotected outdoor locations.



Sensor Wire Color	Connection
Red	+5Vout
Black	GND
Blue (or White)	Data

Category 5 and 5e ethernet network cable has proven to be an effective and low-cost solution for extending the temperature sensor leads. Extensions of up to 600ft have been successful. Do not route the sensor cable in the same conduit with the solenoid valves or other AC wiring. Protect any electrical connections from the weather.

2.3.6 Network Connection

Connect the Ethernet port to an Ethernet hub, switch, or router. For configuration, the SmartStorm may be temporarily connected directly to the Ethernet port on a computer by using a crossover Ethernet cable.

The SmartStorm can be used on a wireless network by making a connection through an Ethernet bridge or a wireless router.

Note: *The wireless Ethernet bridge or router must be properly configured for the wireless network. Refer to the installation instructions for the wireless device.*

2.3.7 Security

The SmartStorm Irrigation Controller does not employ a general purpose computer operating system and does not have features such as telnet, FTP, SSH, nor uncontrolled open ports. This means it is unlikely for someone to 'break in' to the SmartStorm and access other devices on your local network. The simplicity of the SmartStorm makes it an inherently secure device. Nevertheless, as with any device installed on a network, appropriate security precautions should be observed.

If the SmartStorm is installed on the Internet, it is recommended that passwords be enabled for the ***Control Page****. Passwords should be at least 8 characters in length and use a combination of upper and lower case letters and numbers. For additional security, a firewall may be used to limit access to selected IP addresses. Another option may be to set up a Virtual Private Network (VPN) between the network where the SmartStorm resides and the client machine (web browser, another, ControlByWeb™ product, etc.).*

Section 3: Configuration and Setup

3.1 Establishing Communications for Setup

In order to configure the SmartStorm with a web browser interface, the SmartStorm must be connected to an Ethernet network. This can be done by one of two methods:

Basic Method – Temporarily change the IP address of a connected computer to the match the default IP address used by the SmartStorm.

-or-

Advanced Method – Assign a temporary IP address to the SmartStorm to work on an existing network.

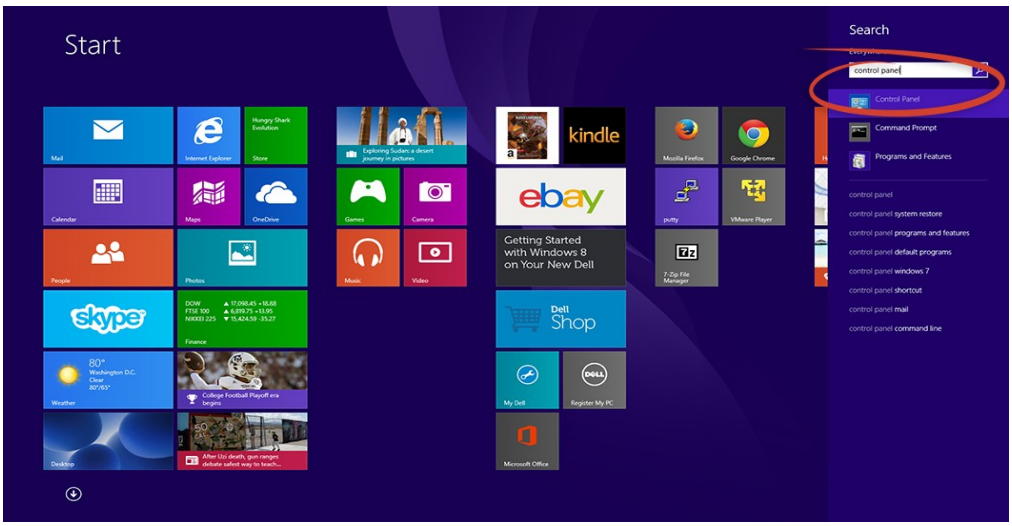
Note: *If multiple ControlByWeb™ products are used on the same network, install one at a time and set the IP address of each unit before connecting the next unit to the network. This avoids having multiple devices being installed on the network with the same factory default IP address at the same time. If this approach is used, be sure to clear the arp cache after disconnecting each unit (`arp -d`).*

3.1.1 Basic Method: Assign a Temporary IP Address to the Configuration Computer

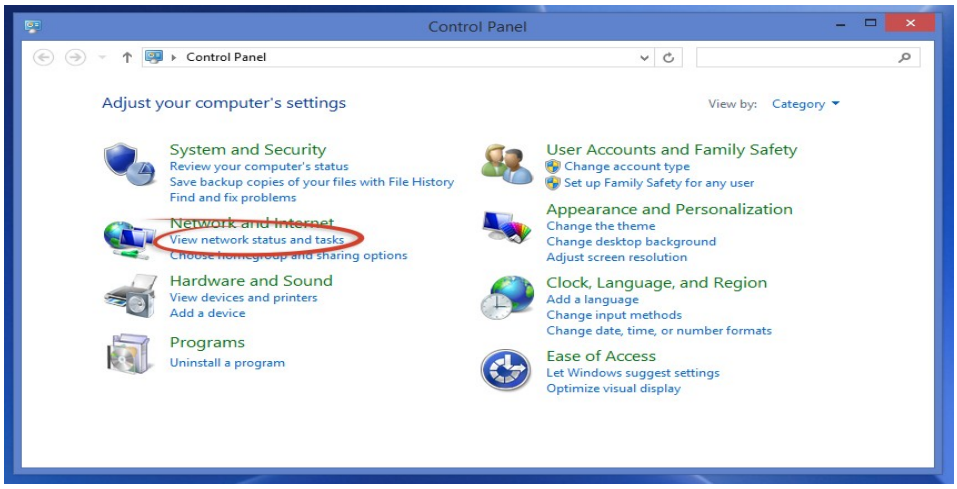
By default, the SmartStorm comes from the factory with an IP address of 192.168.1.2. Communication with the SmartStorm may be established by assigning an IP address to the configuration computer so that it is on the same network as the SmartStorm (for example, the configuration computer could be assigned to 192.168.1.50)

The following example is for those running the Windows-8 operating system:

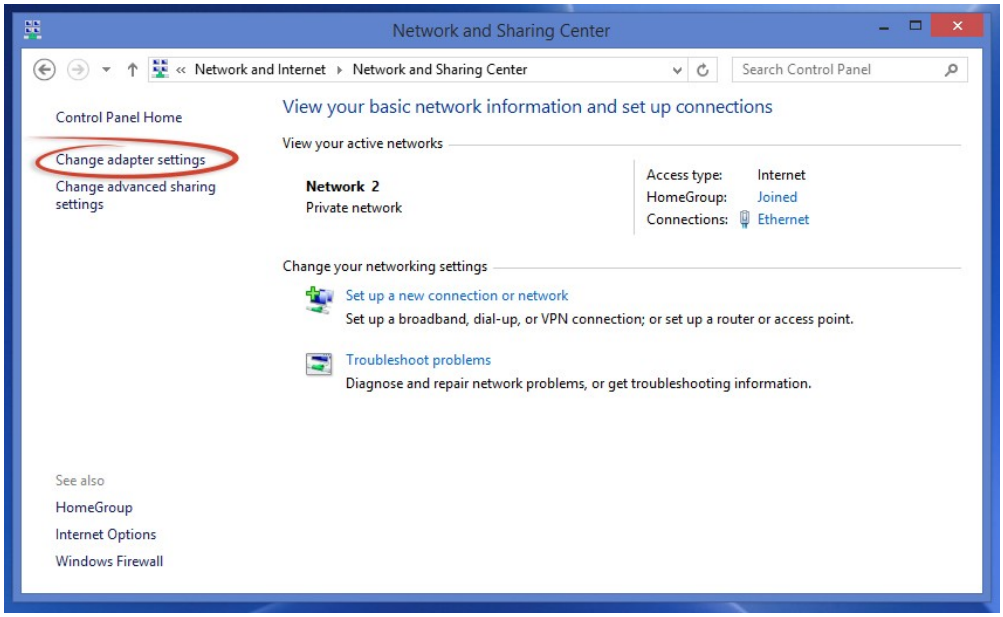
1. Apply Power, wait 15 seconds for the SmartStorm to become operational, and then connect the Ethernet cable.
2. Open the Windows 8 start screen.
3. Type "**Control Panel"** and press enter (the search box opens automatically when you begin typing).



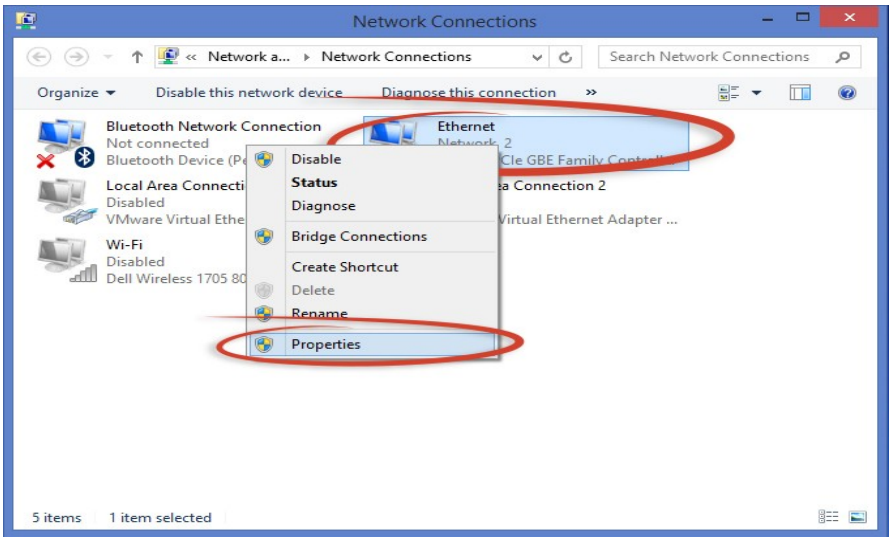
4. Click or touch **View network status and tasks**.



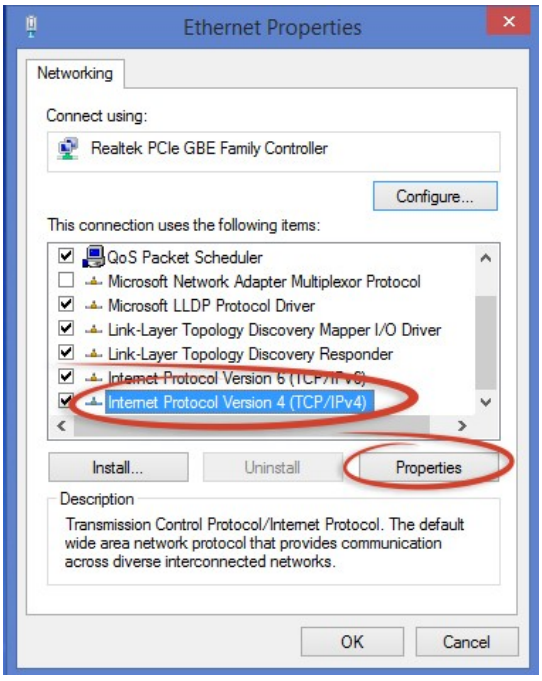
5. Click or touch **Change adapter settings**


Network and Sharing Center
Network and Internet ▸ Network and Sharing Center
Search Control Panel
Control Panel Home
Change adapter settings
Change advanced sharing settings
View your basic network information and set up connections
View your active networks
Network 2
Private network
Access type: Internet
HomeGroup: Joined
Connections: Ethernet
Change your networking settings
Set up a new connection or network
Set up a broadband, dial-up, or VPN connection; or set up a router or access point.
Troubleshoot problems
Diagnose and repair network problems, or get troubleshooting information.
See also
HomeGroup
Internet Options
Windows Firewall

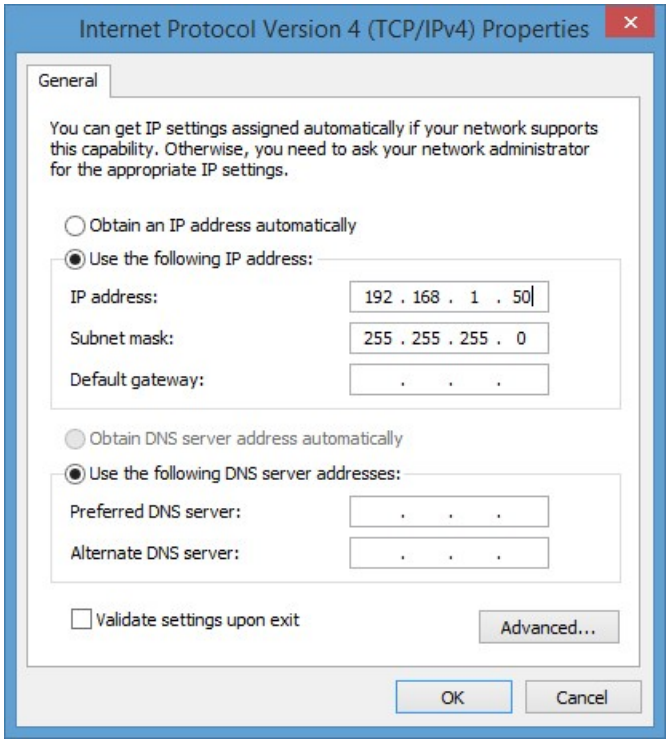
6. Your machine may have more than one Internet connection shown. Right click on the adapter for your connection to the internet. A drop down box will appear, choose **Properties** to view/edit the settings for this internet connection.



7. Select **Internet Protocol Version 4 (TCP/IPV4)** and then click the **Properties** button.



8. If “Use the following IP address” is already selected, the computer has been setup with a static IP address. Record these values so that the current IP address of the computer can be restored once the IP address of the SmartStorm has been successfully changed.


Internet Protocol Version 4 (TCP/IPv4) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
192 . 168 . 1 . 50
Subnet mask:
255 . 255 . 255 . 0
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Validate settings upon exit
Advanced...
OK
Cancel

Select the radio button labeled "**Use the following IP address**" and type in the IP address:

```
192.168.1.50
```

Type in the subnet mask:

```
255.255.255.0
```

No need to change the default gateway field. Click **OK** to accept the new settings.

9. Open the setup pages by entering the following URL in the address bar of a web browser:

   ```
   http://{ipaddress}/setup.html
   ```

   (For example: http://192.168.1.2/setup.html)

   Note: *If the setup pages are not accessible, verify that the SmartStorm is powered on and that the LINK light is illuminated. Check all network connections and settings.*

   Another way to check communications is to ping the SmartStorm from the command prompt by typing:

   `ping [ipaddress]` (e.g. `ping 192.168.1.2`)

3.1.2 Advanced Method: Assign a Temporary IP address to the SmartStorm Irrigation Controller

This option (arping) is used to TEMPORARILY assign an IP address to the SmartStorm without the need to change the IP address of the configuration computer. The SmartStorm will use this IP address as long as power is maintained. Once power is lost, the SmartStorm will use the IP address assigned in the setup page and not the temporary address assigned here. Make sure that SmartStorm and the configuration computer are connected to the same network. Since ARP is non-routable, this will not work through routers or gateways.

3.1.2.1 Microsoft Windows Instructions

1. Open a Command Prompt (select START, then RUN, then type “cmd”).

   Note: *For Vista, 7, 8, and 8.1, the Command Prompt should be run as administrator (select Start, then type “cmd” and right click on “cmd” and select “Run as administrator”).*
2. Type:

   ```
   arp -s {new IP address} {serial number of SmartStorm Irrigation Controller }
   ```

   Note: *IP address format is xxx.xxx.xxx.xxx. The serial number can be found on a label on the module board. The format is ss-ss-ss-ss-ss-ss.*
   For example, to set the SmartStorm Irrigation Controller (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

   ```
   arp -s 10.10.10.40 00-0c-c8-01-00-01
   ```
3. Next, type:

   ```
   ping -l 102 {new IP address}
   ```

   For example, if the new IP address is 10.10.10.40, the following command would be used:

   ```
   ping -l 102 10.10.10.40
   ```
4. Proceed with the SmartStorm setup in section 4.

Once setup is complete, it may be necessary to clear the 'arp' cache to configure additional units. This is necessary because each unit has the same default IP address, but a different unit serial number (MAC address). Clearing the arp table can be done by typing `arp -d` in the command prompt window.

3.1.2.2 Linux/Unix Instructions

1. Open a terminal and change to root user (su -, then enter root password).
2. Type:

   ```
   arp -s {new IP address} {serial number of the SmartStorm Irrigation
   Controller}
   ```

   Note: *IP address format is xxx.xxx.xxx.xxx. The serial number can be found on a label on the module board. The format is ss:ss:ss:ss:ss:ss.*
   For example, to set the SmartStorm (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

   ```
   arp -s 10.10.10.40 00:0c:c8:01:00:01
   ```
3. Next, type:

   ```
   ping -s 102 {new IP address}
   ```

   For example, if the new IP address is 10.10.10.40, the following command would be used:

   ```
   ping -s 102 10.10.10.40
   ```
4. Proceed with the SmartStorm setup in section 4.

Once setup is complete, it may be necessary to clear the 'arp' cache to configure additional units. This is necessary because each unit has the same default IP address, but a different unit serial number (MAC address). Clearing the arp table can be done by typing `sudo arp -d -a` in the command prompt window.

3.1.2.3 Mac OS X Instructions

1. Open a terminal.

   Note: *The terminal is in the "Utilities" directory, which is in the "Applications" directory.*
2. Type:

   ```
   sudo arp -s {new IP address} {serial number of the SmartStorm Irrigation
   Controller }
   ```

   Administrator password may be required.

   Note: *IP address format is xxx.xxx.xxx.xxx. The serial number can be found on the label on the module board. The format is ss:ss:ss:ss:ss:ss.*
   For example, to set a SmartStorm (with serial number 00-0C-C8-01-00-01) to 10.10.10.40 the following command would be used:

   ```
   sudo arp -s 10.10.10.40 00:0c:c8:01:00:01
   ```
3. Next, type:

   ```
   ping -s 102 {new IP address}
   ```

   For example, if the new IP address is 10.10.10.40, the following command would be used:

   ```
   ping -s 102 10.10.10.40
   ```
4. Proceed with the SmartStorm setup in section 4.

Once setup is complete, it may be necessary to clear the 'arp' cache to configure additional units. This is necessary because each unit has the same default IP address, but a different unit serial number (MAC address). Clearing the arp table can be done by typing `sudo arp -d -a` in the command prompt.

Section 4: Setup Pages

The SmartStorm Irrigation Controller is configured using a web browser. To access the setup pages, enter the following URL in the address bar of a web browser:

```
http://{ipaddress}/setup.html
```

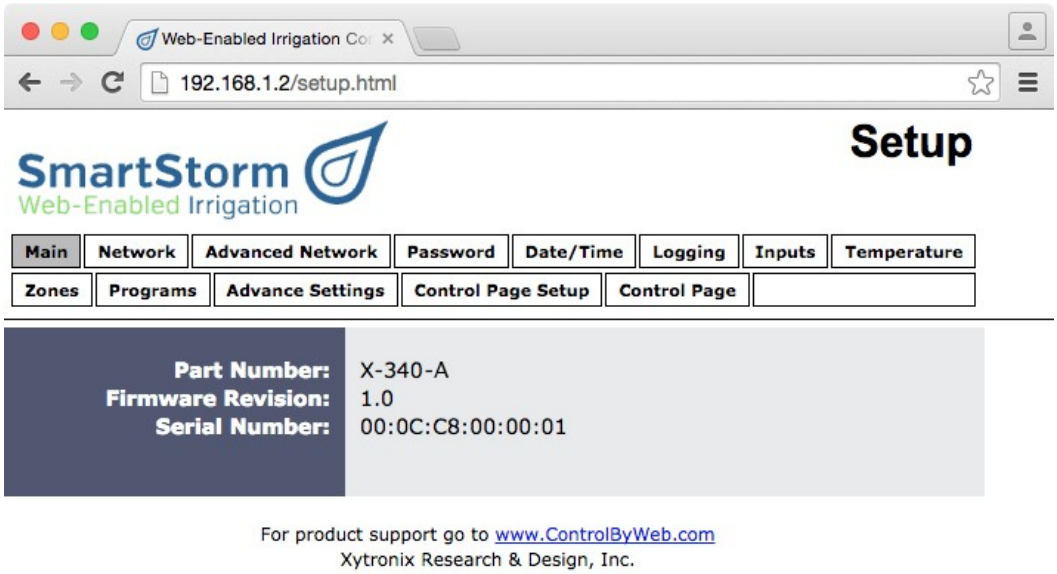
For example, using the default IP address, enter:

```
http://192.168.1.2/setup.html
```

After the page is requested, a password prompt will appear. Enter the username and password. The default username is `admin` and the default password is `webrelay` (password is case sensitive).

4.1 Main Tab

This is the initial page that is displayed when setup.html is entered into the address bar of the browser. It displays model and serial number information, and allows the user to configure the temperature sensor.



Part Number

This is the full model number of the SmartStorm.

Firmware Revision

This is the current product revision of the unit's firmware.

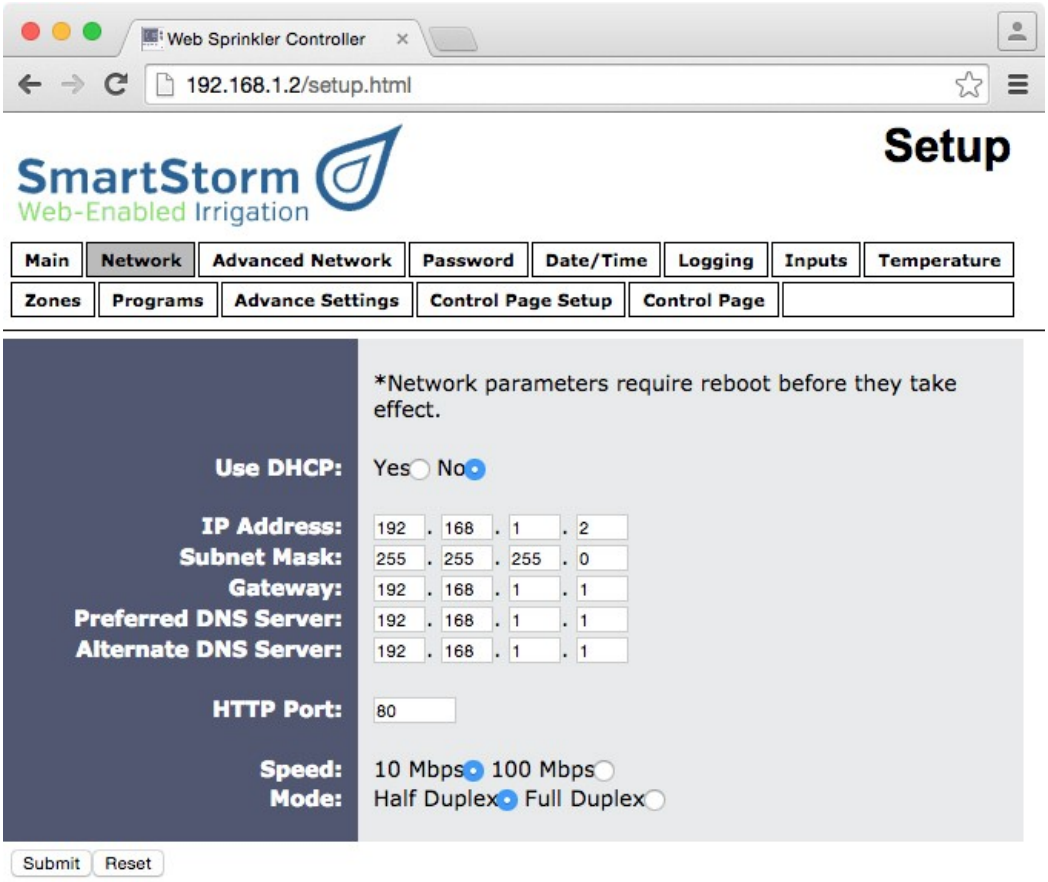
Serial Number

This is the serial number of this unit. The serial number is also the MAC address of the unit.

4.1.1 Network Tab

The network parameters are set on this page.

Note: *The SmartStorm must be power-cycled (power disconnected, then reconnected) before network settings take effect. Only the settings on the* ***Network*** *tab require power-cycling before taking effect.*



Use DHCP

This option allows DHCP to be enabled or disabled. If this option is set to ***Yes***, the SmartStorm will wait for an IP address from a DHCP server each time it is powered. The default setting is ***No*** (this is recommended for most installations). If DHCP is set to ***Yes***, the Network page must be submitted and the SmartStorm must be rebooted before an IP address will be assigned. Once the SmartStorm is assigned an IP address by the DHCP, the new IP address can be found through the clients list kept by the DHCP server. For most instances, this is found on the local gateway or router.

Brief Notes About DHCP

All devices on an IP network require an IP address. This is a unique address that identifies each device on the network. DHCP (Dynamic Host Control Protocol) is a mechanism that automatically assigns an IP address to a computer (or other devices) when it is connected to a network. This eliminates the need to manually enter the IP address. When a computer is connected to the network, another device on the network called a DHCP server detects the presence of the computer and dynamically assigns the IP address to that computer. On many small networks, the DHCP server is built into the router.

DHCP works well for "client" devices such as computers, but is not ideal for servers. This is because

servers usually don't initiate communications with other devices, but rather they wait for a request from "clients." To make this request, the client must know the IP address of the server. If a server gets its IP address dynamically, the IP address may not always be the same so client devices may not be able to find the server. For this reason, servers usually use an IP address that is fixed and does not change. The SmartStorm is a server and manual IP address assignment is usually recommended.

IP Address

Enter the IP address for the SmartStorm in this field. The IP address is specific to the network where the SmartStorm will be installed, and must be obtained from the network administrator. For more information on IP addresses and remotely accessing the SmartStorm over the Internet, see **Appendix C: Accessing the SmartStorm Irrigation Controller Remotely Over the Internet**. The default setting for this field is 192.168.1.2.

Subnet Mask

The subnet mask defines the size of the local network. This must be obtained from the network administrator. For additional information about sub-netting and IP networking, many tutorials are available on the Internet. The default setting for this field is 255.255.255.0.

Gateway

This specifies the IP address of the gateway router. This must be obtained from the network administrator. The default setting for this field is 192.168.1.1.

Preferred DNS Server

The IP address of the Primary DNS server is specified here. When DNS services are required, this is the address that will be used. The default setting for this field is 192.168.1.1.

This field is only required when the following options are used:

- **Remote Services** (when server is specified by name and not IP address).
- **Sync time clock with remote NTP server** (when server name is specified by name and not IP address).

Alternate DNS Server

This field is used to specify the IP address of a Secondary DNS server. This is used when the SmartStorm requires DNS services and the preferred DNS server is not available. The default setting for this field is 192.168.1.1.

HTTP Port

The TCP port used for HTTP communications (web browser, XML, get commands) with the SmartStorm is specified here. The default setting for this field is 80, which is the standard HTTP port. It is recommended that the port be left unchanged unless the user has an understanding of TCP/IP and ports. For more information on TCP ports and IP addressing see **Appendix C: Accessing the SmartStorm Irrigation Controller Remotely Over the Internet**.

Speed

This option sets the data rate (clock rate) of the Ethernet port. Either ***10 Mbps*** or ***100 Mbps*** can be selected. The ***100 Mbps*** option offers faster communications but the amount of data to and from the SmartStorm is so small that users will not likely notice much (if any) difference. When the SmartStorm is set to ***10 Mbps***, it draws less power and runs a little cooler, which may translate into a longer product life. The default setting for this field is ***10 Mbps***.

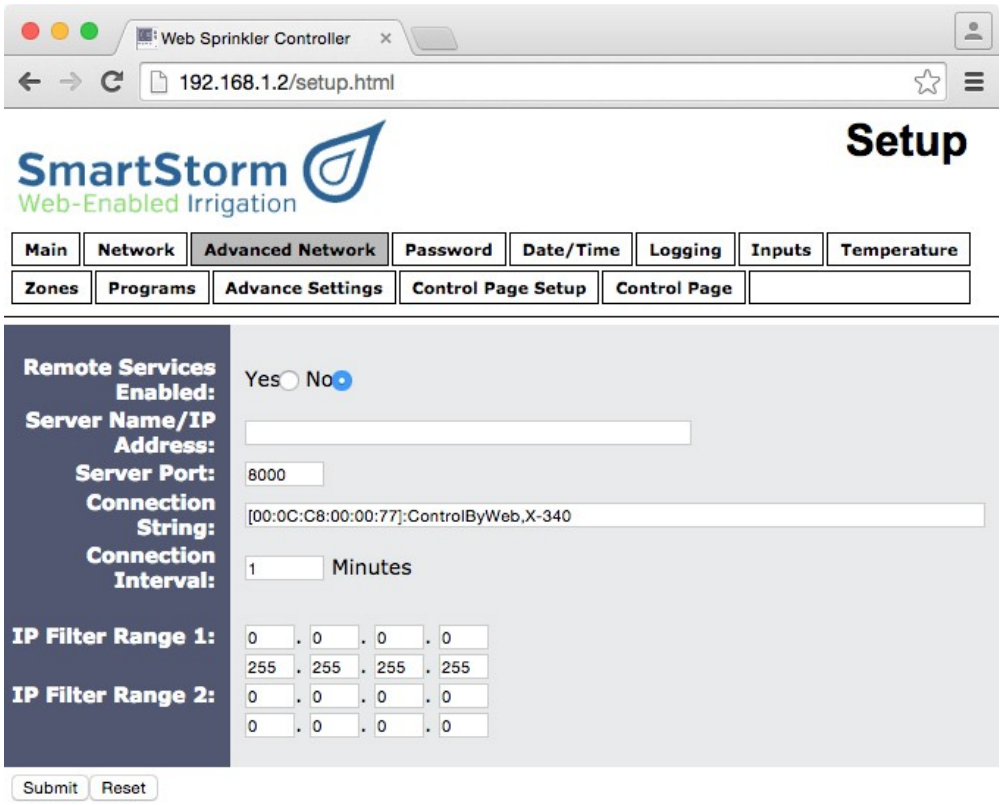
IT IS RECOMMENDED THAT THIS SETTING BE LEFT AT **10Mbps** UNLESS THE USER HAS A SPECIFIC REASON TO USE **100Mbps**.

Mode

This option allows the Ethernet port to be set to ***Half Duplex*** or ***Full Duplex***. Legacy Ethernet operates in ***Half Duplex*** mode which means that devices can either send data or receive data, but not both at the same time. ***Full Duplex*** means that devices can send and receive data at the same time. The default setting for this field is ***Half Duplex***.

4.2 Advanced Network Tab

Note: *These settings are not used for most installations.*



Remote Services Enabled

This option enables or disables Remote Services. If ***Yes*** is selected, Remote Services will be enabled as soon as the submit button is pressed and the SmartStorm will immediately attempt to make a connection with the remote server (power cycle not required). Once a connection is established, the connection will remain until it is disconnected by the remote server. Proper connection with the remote server can be verified by viewing the system status log file (see **Appendix D: Log Files**). The default setting for this field is ***No***. Most users should leave this setting at its default. (See **Remote Services** at the end of this section for more information.)

Server Name/IP Address

Specify the name or IP address of the Remote Services server here. If the IP address is specified, enter it in this format aaa.bbb.ccc.ddd. For numbers that are less than 100, preceding zeros should not be included (for example, enter 80 rather than 080). This field can be up to 40 characters long and has no default setting.

Server Port

Enter the TCP port used for the Remote Services server. This can be set within the range of 0-65535. The default setting for this field is 8000.

Connection String

This text is sent to the Remote Services server when the connection is established. This string should include any information required by the server at connection. For example, it may include an ID number, customer number, password, etc. The format is entirely dependent upon the server requirements. This field can be up to 80 characters long. Default text is provided only as an example placeholder. The default text is [<`serialAddress`>]:ControlByWeb,X-340.

Connection Interval

This field specifies the periodic interval in which the SmartStorm attempts to connect to the remote server, or if the SmartStorm is already connected, it is the interval in which the SmartStorm sends the connection string. This field can be set within the range of 1 to 34452 minutes. The default setting for this field is 1 minute.

IP Filter Range 1 and IP Filter Range 2

For additional security, the SmartStorm has a simple built-in firewall. If desired, the SmartStorm can be configured to only allow access to client devices (computers, servers, other ControlByWeb™ devices, etc) with certain IP addresses. Two IP address ranges are provided and only client devices with addresses that fall within those two ranges will be allowed access. Devices with IP addresses that fall outside of those ranges will not receive any response from the SmartStorm. The following are examples.

To allow access from any device (this is the default setting):

IP Filter Range 1:	`0.0.0.0` `255.255.255.255`
IP Filter Range 2:	`0.0.0.0` `0.0.0.0`

To limit access to only one device (address 192.168.1.33):

IP Filter Range 1:	`192.168.1.33` `192.168.1.33`
IP Filter Range 2:	`0.0.0.0` `0.0.0.0`

To limit access to only devices on the local network and one device on the internet (address 10.143.100.32):

IP Filter Range 1:	`192.168.1.0` `192.168.1.255`
IP Filter Range 2:	`10.143.100.32` `10.143.100.32`

Note: *The address specified for the Remote Services server (if applicable) is automatically allowed through the firewall no matter how this is set.*

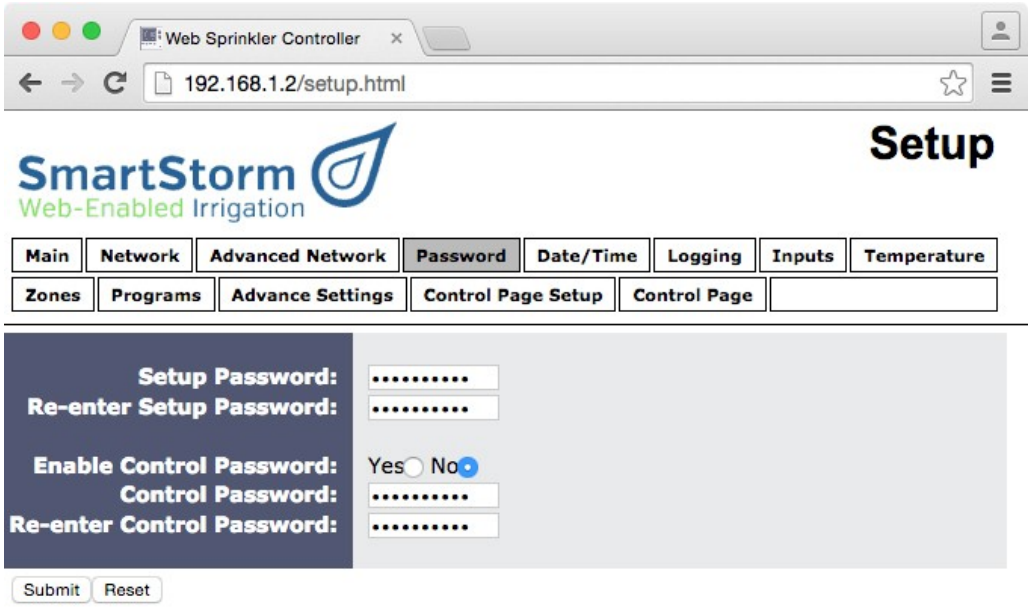
4.2.1 Remote Services

Remote Services initiates an outgoing connection to a server at a remote location. This can be used in an environment where a web server on the Internet provides a custom web page for the SmartStorm and other ControlByWeb products. Users access the SmartStorm through the web server rather than communicating directly with it. This method is sometimes referred to as “web services” and allows programmers to create powerful, custom web pages to multiple devices using the web programming languages of their choice.

Remote Services initiates the connection to the external web server (rather than the web server initiating communications to the SmartStorm). This has two main benefits. First, the web server does not need to know the IP address of the SmartStorm. This means that the SmartStorm can get its IP address dynamically from a DHCP server, simplifying the installation. Second, since the connection from the SmartStorm is outgoing, rather than incoming, the local router on the network where the SmartStorm resides doesn't need to be configured to forward sockets. This also simplifies the installation. Since the router configuration is not modified, the risk of compromising security on the local network is eliminated. For more information about the **Remote Services see Appendix E: External Server and Remote Services**.

4.3 Password Tab

The SmartStorm requires a password to log into the setup pages. The password can be changed on this page. Additionally, the installer can enable the requirement for a **Control Page** password.



Setup Password

The Setup Password, which is required to access the setup pages, can be modified by entering a new password here. Passwords that are 8 characters or longer (up to 13 characters can be entered in this field) with both alphabetic and numeric characters are recommended. For security purposes, the password will not be displayed as it is entered. Note that the username required for accessing the setup pages is `admin` (all lower case). The default Setup Password is `webrelay` (also all lower case).

Re-enter Setup Password

When the Setup Password is changed, it must be entered twice. One time in the previous field and a second time in this field. If the password is not entered identically in both fields, the password will not be changed.

Enable Control Password

The **Control Page** can be viewed without entering a password. For security purposes, a password can be required for access to the **Control Page**. When this field is set to ***Yes***, a password will be required to view the **Control Page**. The default setting for this field is ***No***.

Control Password

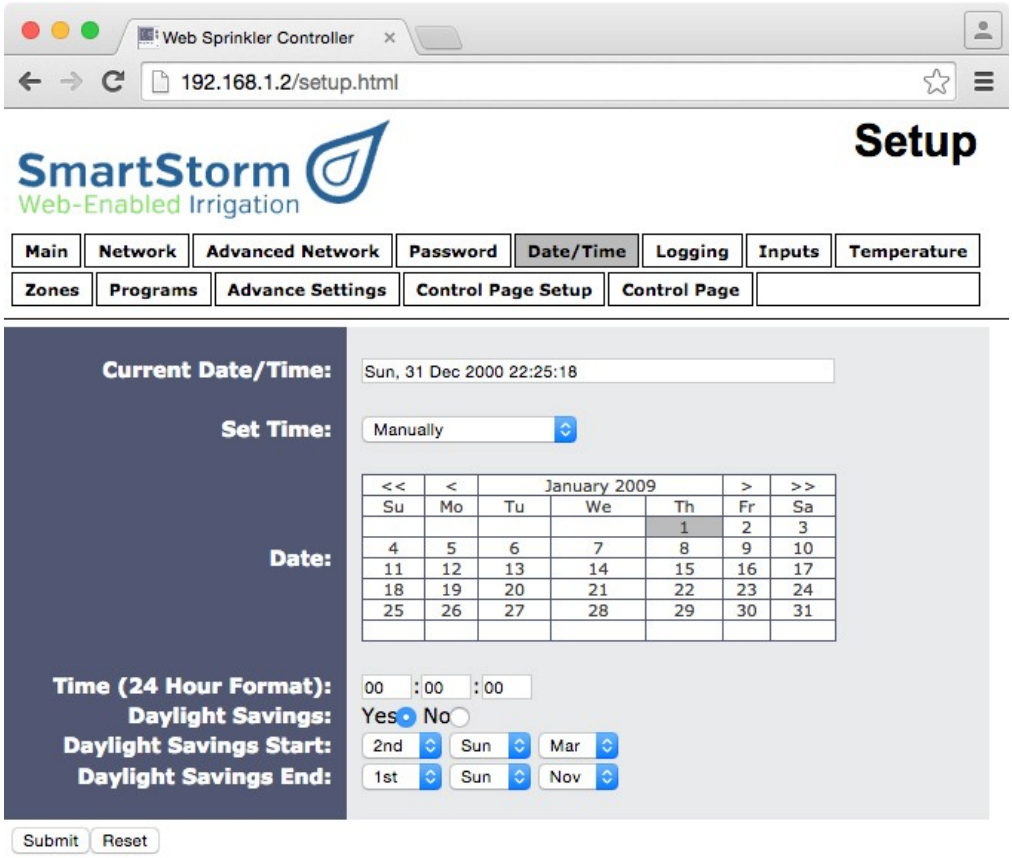
When the Enable Control Password option above is set to ***Yes***, this field is used to specify the password which will be required to access the **Control Page**. Passwords that are 8 characters or longer with both alphabetic and numeric characters are recommended. For security purposes, the password will not be displayed as it is entered. Note that the SmartStorm requires a password, but does not require a user name to access the **Control Page**. However, some browsers require that a user name be entered. In this instance enter none as the user name. The default Control Password is `webrelay`.

Re-enter Control Password

When the Control Password is changed, it must be entered twice. One time in the previous field, and a second time in this field. If the password is not entered identically in both fields, the password will not be changed.

4.4 Date/Time Tab

The SmartStorm uses the time for program start times, zone run times, and for logging (a time stamp is included with each logged event). The time is stored and displayed in 24-hour time format. The SmartStorm has a capacitor-backed real-time-clock circuit that will keep track of time for several weeks in the event of a power failure.



Current Date/Time

This is the current date and time stored in the SmartStorm. The time is stored and displayed in 24-hour format.

Set Time

This drop-down list offers two options for setting the time: ***Manually*** or ***Sync with NTP server***.

The options that follow this field will change based upon how this option is set.

- ***Manually*** requires the user to enter the time and date. When this option is selected, parameters Date and Time appear.
- ***Sync with NTP server*** allows the user to set the clock automatically by using an NTP (Network Time Protocol) server.

4.4.1 Manual Time Configuration

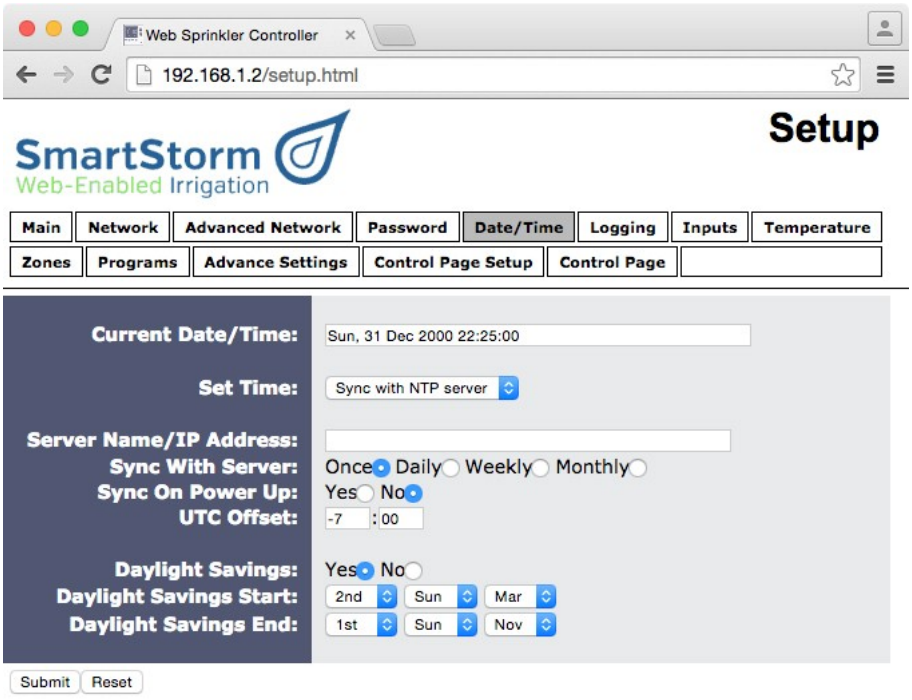
Date

The current date is entered by first selecting the correct month and year, using the left and right arrows at the top of the calender. The single arrows(< and >) change the month and the double arrows (<< and >>) change the year. Once the current month and year are displayed, select the correct day, which will then be highlighted.

Time (24 Hour Format)

Enter the time as HH:MM:SS. (HH represents hours in 24-hour format [00-23], MM represents minutes [00-59], SS represents seconds [00-59].)

4.4.2 NTP Time Configuration



Server Name/IP Address

This field is used to specify the name or IP address of the NTP server. If a name is specified, a working DNS server address must be entered into the Network settings. If the IP address is specified, it should be entered in the following format aaa.bbb.ccc.ddd where each of the letters represents a number between 0 and 255. This field can be up to 40 characters. There is no default value for this field.

Many NTP Internet servers are available. In addition, many desktop computers will function as an NTP server (both Mac and PC). If a desktop computer is used, firewall settings may need to be adjusted to allow for NTP communications on port 123.

Public NTP servers can be found at www.pool.ntp.org.

Sync With Server

This option allows the user to specify how often the SmartStorm time will be synchronized with the time server. When the submit button on this page is pressed, the SmartStorm will immediately synchronize

with the time server. If Daily, Weekly, or Monthly options are selected, the SmartStorm will thereafter re-synchronize with the time server at the period interval specified starting at 12:00 AM (00:00).

The exact time the NTP Request occurs is 12:00 AM (00:00) plus the minute equivalent of the last two digits in the models serial number. For example, if the last two digits in the model's serial number were -09, the NTP Request will occur 9 minutes after 12:00 AM. The default value of this setting is Once (the unit will immediately sync with the NTP server, but will not automatically sync again).

Sync on Power Up

When this option is set to ***Yes*****,** the SmartStorm will be synchronized with the time server each time it is powered.

Note: If the SmartStorm will lose power on a frequent basis, it may be beneficial to set this option to **No**; some servers are configured to dis-allow access from client devices that excessively request their services. The default value of this setting is **No.**

UTC Offset

Time servers return the current time in Universal Time (GMT). It is common for many servers and data loggers to use GMT as their official time, even when they are not located within the GMT time zone. The default value for this field is -7 (Mountain Standard Time). For convenience, the time can be converted to local standard time by entering the offset here. This manual cannot include the UTC Offset for all parts of the world, but the offset for GMT time and the four major US Time zones are listed here.

GMT Time: 0
Eastern Standard Time: -5
Central Standard Time: -6
Mountain Standard Time: -7
Pacific Standard Time: -8

Daylight Savings

In many parts of the United States and in some other countries, the time is shifted forward by one hour during the summer months. This is an effort to conserve energy by making the daylight last longer into the evening hours. If this option is set to ***Yes***, the time in the SmartStorm will automatically be shifted forward by one hour between the hours of midnight and 5:00 AM on the Daylight Savings Start date set below, and it will shift back to standard time between the hours of midnight and 5:00 AM on the Daylight Savings End date set below. The time change is made at a pseudo random time (based on the mac address) within the previously mentioned, five-hour time frame, in order to prevent several different devices from simultaneously requesting a time and overwhelming the NTP server. The default setting is ***Yes.***

Note: *Enabling the daylight savings time adjustment, scheduled events will be adjusted for the new time. Logged data includes a time stamp based upon the current time in the device, so it is possible to duplicate log times in the spring and miss log times in the fall.*

Daylight Savings Start

This is the date that daylight savings will start. Note that on this date, between the hours of midnight and 5:00 AM, the current time will be shifted forward by one hour (i.e. the time will jump from 12:02 AM [00:02] to 1:02 AM [01:02]). By default this is set to the 2nd Sunday in March which is the date used in the United States.

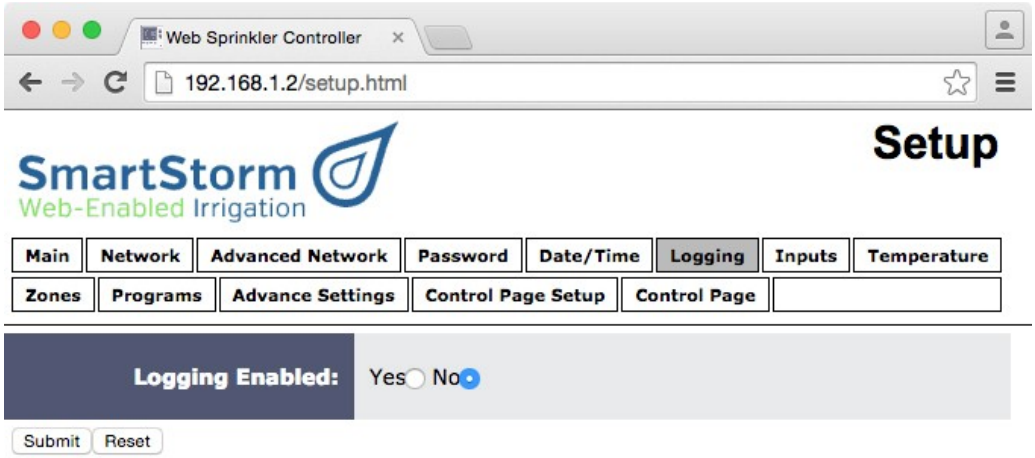
Daylight Savings End

This is the date that daylight savings will end. On this date, between the hours of midnight and 5:00 AM, the current time will be shifted backward by one hour (i.e. the time will jump from 12:02 AM [00:02] to 11:02 PM [23:02] the day before). By default this is set to the 1st Sunday in November which is the date used in the U.S.

4.5 Logging Tab

The SmartStorm can be configured to record data such as zone starts and stops, program changes, etc. The logged data is stored in internal nonvolatile memory and can be retrieved by entering the command http://{SmartStorm IP address}/log.txt. For more information on logging, see **Appendix D: Log Files**.

Note: *Changing the log settings will erase the current log file.*



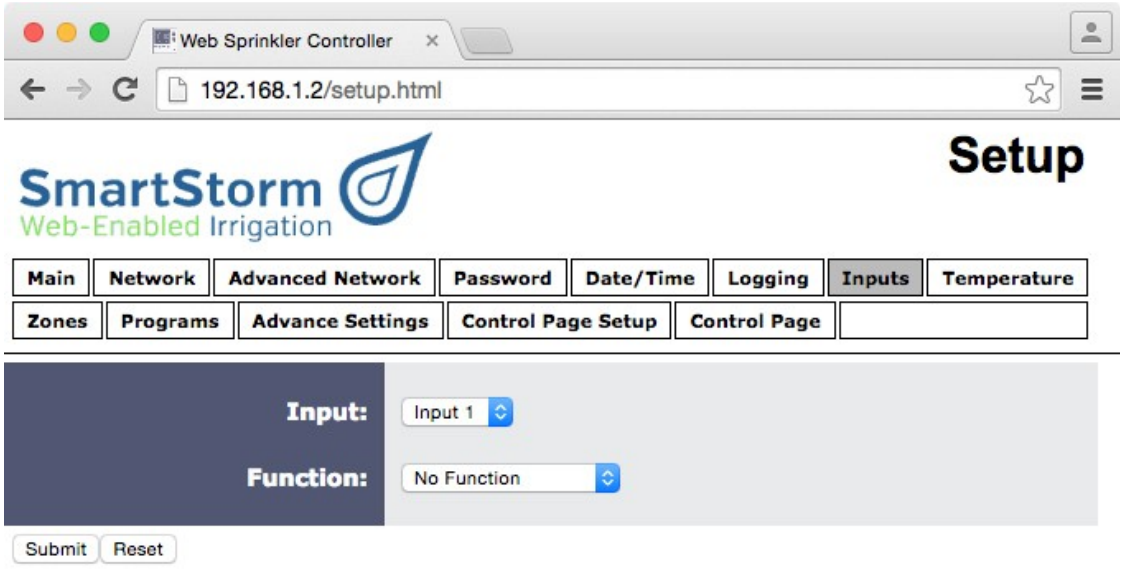
Logging Enabled

When this option is set to ***Yes***, the SmartStorm will record data as configured on this page. The default setting for this option is ***No***.

Note: *This option controls data logging, but not system logging. System logging is always enabled.*

4.5.1 Inputs Tab

This page provides configuration options for the two switch closure inputs built into the SmartStorm.



Note: *In this manual, the input is considered to be* ***ON*** *when the input is connected to ground with a switch or relay.*

Input

This drop down menu is used to select the control input to which the options below will apply.

- ***Input 1*** or ***Input 2***: Selects the corresponding control input.

Function

This drop down menu is used to select the function that the selected input will have.

- ***No Function***: The input has no affect on watering.
- ***ON/OFF Switch***: When the input switch is open (OFF) watering will be inhibited. Any valves currently on will turn off. Programs will not turn valves on while the input switch is open (OFF). Valves can be turned on manually while the input is OFF.
- ***Stop Current Cycle***: If only one program is active, an assertion of the input will stop the program.
- ***Advance Program:*** If only one program is active, an assertion of the input will advance the program to the next Zone and then stop the program if the last zone is active. If no programs are active, assertion of the input will start program A.

4.5.2 Attaching a Rain Sensor

The SmartStorm Irrigation Controller supports “normally open” rain sensors. Most standard rain sensors will work. Do not connect the sensor inputs to a 24VAC power source.

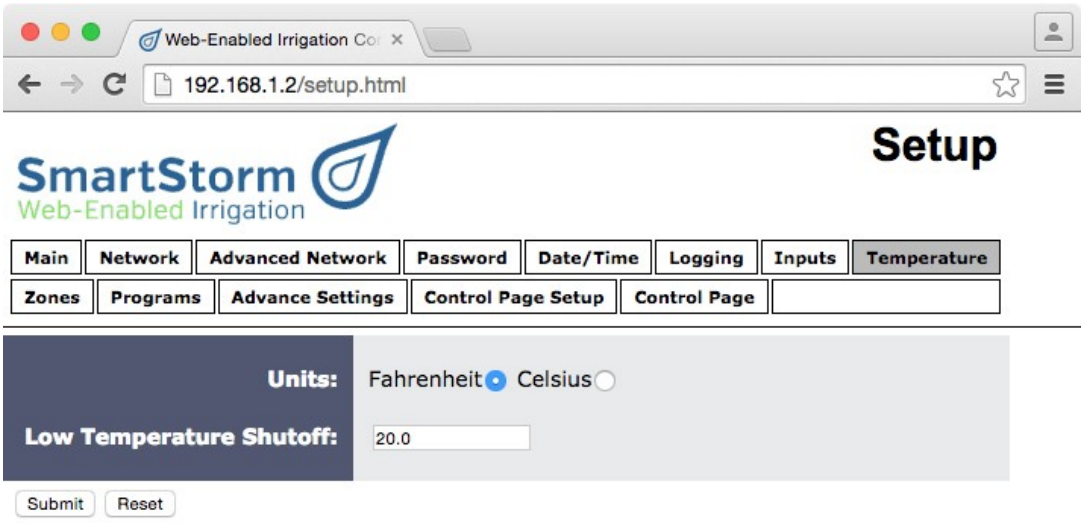
Begin by connecting the rain sensor to Input 1 (or Input 2), and the Gnd terminal. Be sure that the sensor is not connected to any type of power source, as this may damage your unit.

On the Inputs Tab of the setup pages you will choose the input that the rain sensor is plugged into i.e. Input 1, and then select ON/OFF Switch. Then click Submit.

This will allow the controller to be shut off when the rain sensor detects precipitation.

4.5.3 Temperature Tab

This tab is used to configure the low temperature shutoff feature. If no temperature sensor is attached this feature is automatically disabled. If the low temperature shutoff feature is not wanted (and a temperature sensor is connected), set the low temperature shutoff to a super low value such as -50° (max = -67°)



Units

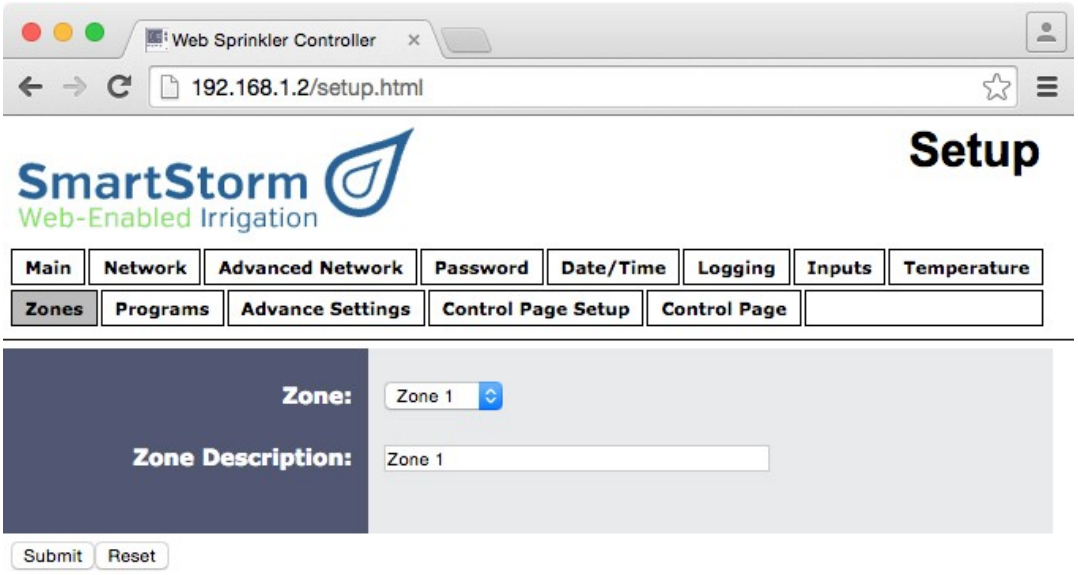
This allows the user to select between the temperature units of ***Fahrenheit*** and ***Celsius***. All settings entered and displayed on subsequent pages will be in the units selected.

Low Temperature Shutoff

This setting is used to set the threshold for the low temperature system shutoff. When the temperature read from the sensor drops below this threshold the unit will turn off the automatic run mode, this will not affect your ability to operate the unit manually. Use this feature to prevent ice buildup or damage to the sprinklers and pipe. You may wish to set the threshold to values in the 40° to 50° range to save water when grass is not actively growing and needs little water.

4.6 Zones Tab

This tab is used to add descriptions for each of the zones. It can also be used to set zones 9 and 10 as master valves.



Zone

This drop-down menu is used to select the zone to which the options below will apply.

Zone Description

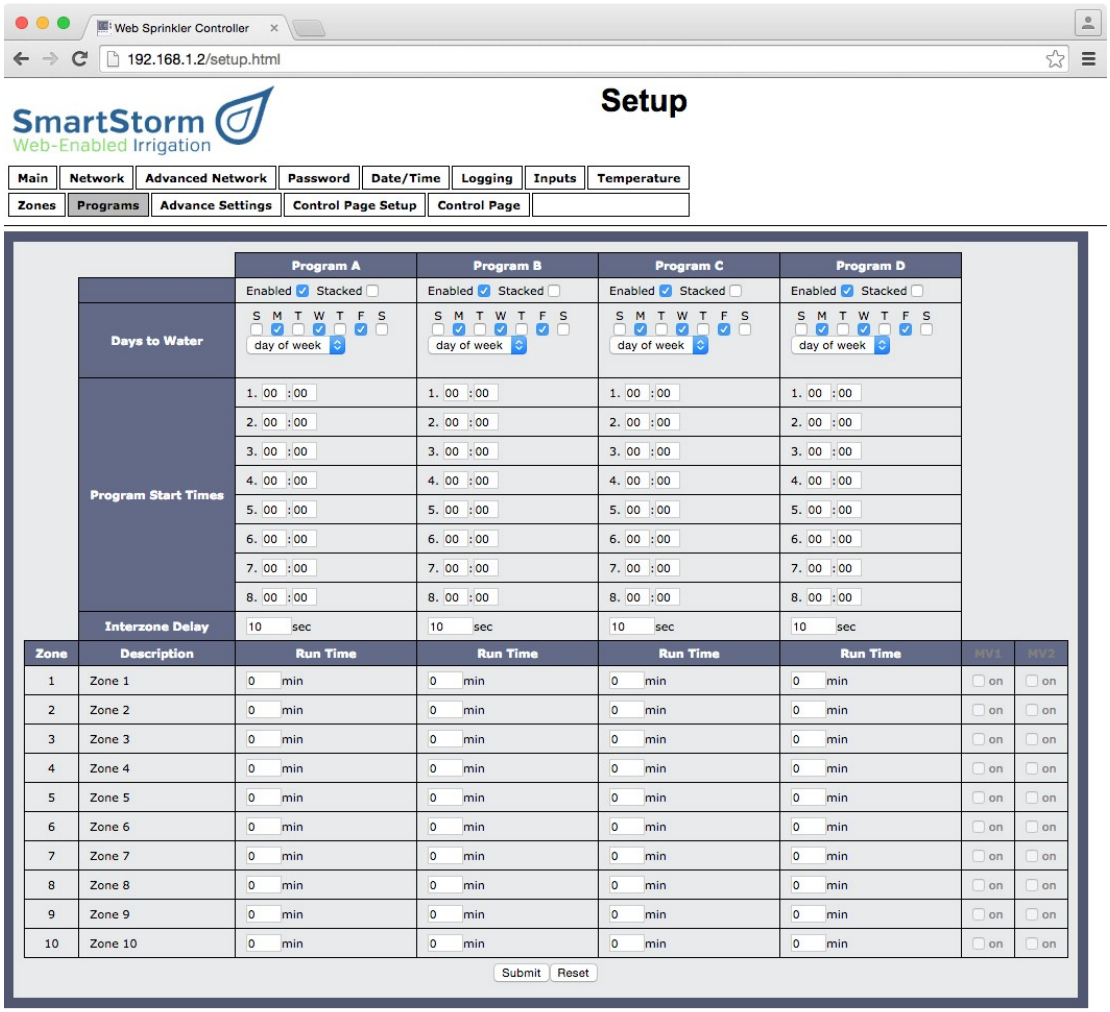
Text entered here will be displayed in the left column of the control page, and should describe the zone. Up to 24 characters may be entered here. The default text is `Zone#`. Change the name to "*Office Front Lawn*", "*Drip Line*" or other descriptive setting.

Master Valve 1 or **Master Valve 2**

Use this check box (when Zone 9 or 10 are selected) to use zone 9 and/or 10 as a master valve control.

4.7 Programs Tab

The SmartStorm has four separate programs (schedules) that can be configured to run with a variety of time and output options. The programs tab is used to configure the programs.



Enabled

Use this checkbox to enable/disable each of the four programs.

Stacked

When this checkbox is selected the SmartStorm will check to see if the number of allowed simultaneous valves is greater than the current number of running valves. If this is the case the program will run the current valve, otherwise it will add the valve to a queue to be run when the unit is no longer busy. This mode will ensure that each zone runs for the desired amount of time and attempt to run them at the desired start times.

If it is not checked and the number of running valves is equal to the number of allowed simultaneous valves, it will disregard the zone that was called, and will wait until the next zone is called.

Days to Water

Use the options here to select the days that you would like to water. All options depend on the day of the week being checked to run the program and not just the Day of Week option. For example, if the program is to run on odd days and only Saturday is checked, then the program will only run on Saturdays that are an odd day of the month. For another example, a local park is frequently used on Saturday and Sunday all day long and it is best to not water on those days. Checking days M - F will enable watering only on those days according to settings for interval, even, or odd days.

Day of Week: This will allow you to select the days of the week that you would like to water.

Interval: This will allow you to set an interval for which days you would like to water, i.e. every other day, every three days, etc. If M-F are checked and interval is every 3 days, the system will only operate every 3 days when the day falls on M-F.

Even Days: This will set the watering to happen on days with even dates. For example, with “even days” selected, if Sunday, Monday and Friday are checked, it will only water on those days if they occur on even days.

Odd Days: This will set the watering to happen on days with odd dates. For example, with “odd days” selected, if Sunday, Monday and Friday are checked, it will only water on those days if they occur on odd days.

Start Times

You are able to add up to eight start times for each program. Hours should be entered in 24-hour format [00-23]. The minutes are entered in the second box [00-59]. The program will run through all the Zones that have a non-zero run time beginning at each start time.

Interzone Delay

The interzone delay is the time that the SmartStorm will wait between turning off one zone and turning on the next zone. This time is set in seconds and can range between 0 – 224. The default value is 10.

Note: *MV1 and MV2 will also be turned off during the interzone delay. Please plan accordingly if MV1 or MV2 are being used to control pumps*

Run Time

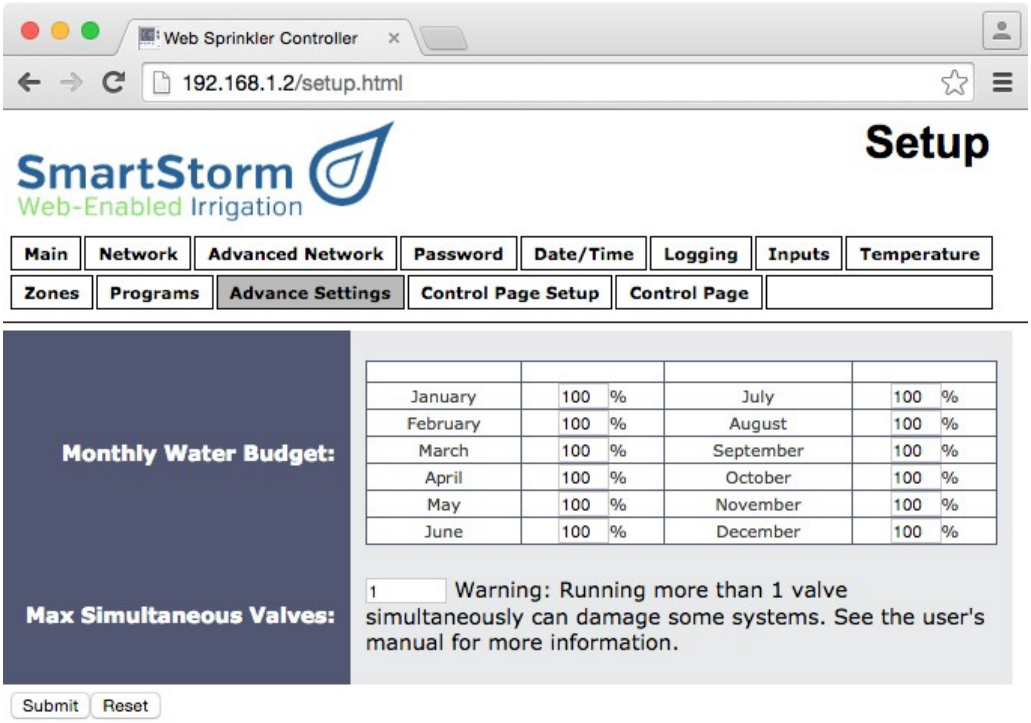
The values that are entered here will determine how long each zone will run. If you don't want a zone to run, then set the time to 0. Values entered can be between 0 – 224. All the values are set to 0 by default.

MV1 or **MV2**

Use these checkboxes to turn on main valve 1 or 2 when the corresponding zone is set to run. If the checkboxes are disabled, you can enable them by setting zone 9 or 10 as a master valve on the Zones Tab.

4.8 Advance Settings Tab

This tab is used to setup the advanced watering options.



Monthly Water Budget

Here you can adjust the monthly overall water budget as a percent [0-100]. The percentage will modify the time that the zones run as set in the programming tab. The default value is 100%.

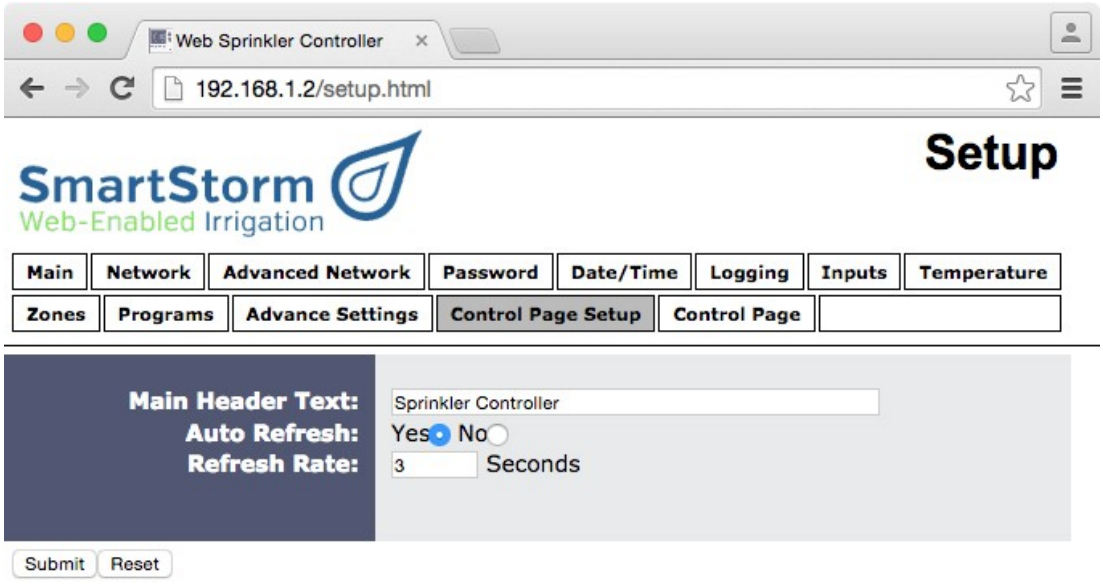
Max Simultaneous Valves

The value set here specifies the maximum number of valves that can operate simultaneously. The default value is 1 [1-2].

Warning: *When operating more than one valve at a time make sure you power SmartStorm with a large enough transformer to support multiple valve operation. Note that enabling stations 9 and/or 10 to function as a master valve or pump controller requires a transformer for multiple valve support.*

4.9 Control Page Setup Tab

The **Control Page Setup** page is used to set parameters that affect the view of the **Control Page**, how often it will refresh, etc.



Main Header Text

The text entered here appears at the top of the **Control Page**. This field can be up to 30 characters in length. The default text is `Sprinkler Controller`. Change this to “East Baseball Diamond” or something descriptive for your installation.

Auto Refresh

The Auto Refresh Page option will cause the **Control Page** to continually update its contents by setting a timer in the web page that causes it to be reloaded at a specified time interval. When set to ***Yes***, the web page will be refreshed at the time interval specified in the Refresh Rate setting. When set to **NO**, the web page will need to be manually refreshed to show the current status of the unit in the control page.

Refresh Rate

When the Auto Refresh Page option is set to ***Yes***, this field specifies the time interval in seconds that the page will be refreshed. It can be set from 1 to 32 seconds.

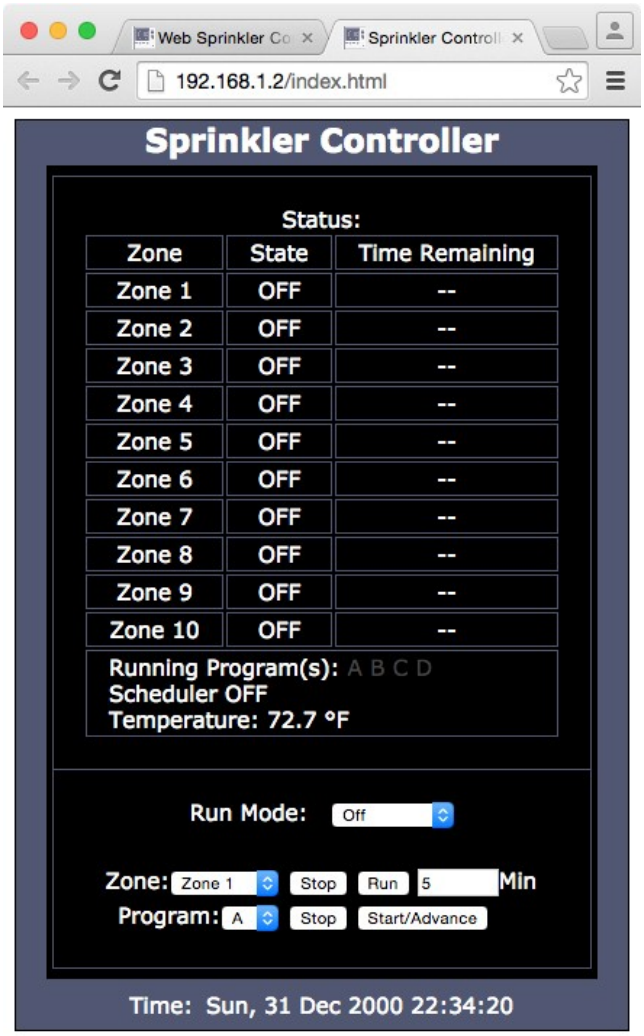
Section 5: Operation

The SmartStorm Irrigation Controller can be operated using a web browser, using a manual pushbutton, using the CBW Mobile app, and/or by sending text commands to an XML status/control page. The watering time can be adjusted using the digital inputs to detect rain or other conditions. (Using a digital input to control the SmartStorm was described throughout previous sections of the manual, and will not be described here.)

5.1 Browser Operation

Once the SmartStorm is set up, users can access the Control Page using a web browser by typing the IP address of the SmartStorm into the web browser address bar. For example, using the default IP address, the user would enter http://192.168.1.2. If the IP address is changed from the default, the user must use the new IP address. Note that if any port is used other than the default port 80, the port must also be included in the request. For example, accessing the unit at port 8000 would be as follows: http://192.168.1.2:8000.

The following screen appears when the Control Page is Selected:



Header

Displays the text entered in the Main Header Text field on the **Control Page Setup** tab in the setup pages.

Zones 1-10

These rows display the current state of the ten zones as well as the time remaining. The text in the left column (by default reads Zone 1, Zone 2, etc.) is specified in the Description field in the **Zones** tab in the setup pages. The state of the zone is shown to the right of the zone description text. The status text will read ***ON*** or ***OFF***. To the right of the relay status, the time remaining is displayed as HH:MM:SS.

Running Programs

This row displays the currently running programs (A, B, C, D).

Scheduler

This row displays the state of the scheduler. If the scheduler is off it will display, **Scheduler Off.** This text will be followed by how it was turned off if it wasn't turned off manually i.e. input1, input2, etc. If the scheduler is running it will display the current water budget, i.e. **Water Budget: 100%**.

Temperature

If a temperature sensor is connected, you will see the temperature displayed next, i.e. **Temperature: 70.0°F.** If a sensor is not attached or is unreadable, this will not be displayed.

Run Mode

This drop down setting allows you to change the state of the scheduler by changing the run mode. If it is set to **Off** then the scheduler will not run the configured programs. When it is set to **Automatic** the scheduler will be turned on.

Zone

This control allows you to start and stop zones manually. The drop-down box allows you to select which zone you would like to control. The **Stop** button will stop the selected zone. The **Start** button will start the zone for the time specified in the text box to the right [1-240]. Note that if you start a zone manually it will abort any running programs until the next scheduled start time. Also note that if a zone is running and it was manually started when an automatic program is scheduled to start, that program will be aborted until the next scheduled start time.

Program

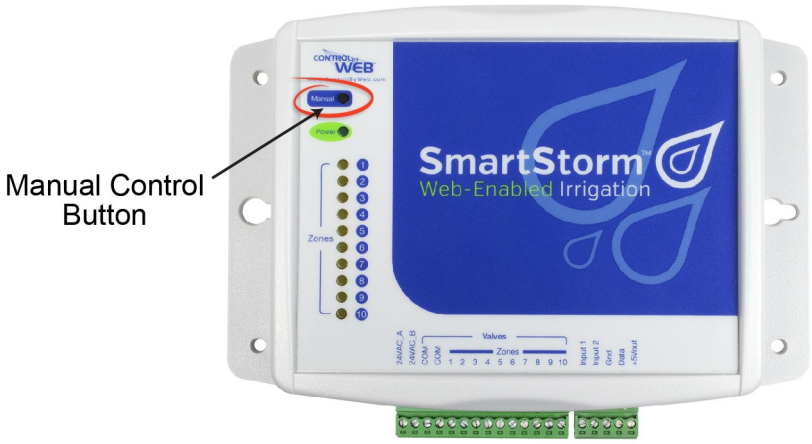
This control allows you to start, advance, and stop programs manually. The drop-down allows you to select which program you would like to control. The stop button will stop the selected program. The start/advance button will start the program, or advance it to the next zone.

Current Time

Displays the current time that is set using the **Date/Time** tab in the setup pages.

5.2 Manual Operation

The SmartStorm Irrigation Controller has an external push button for manual control of your sprinkling system.



Press the manual control button to enter manual control mode. This will cause any zone that is currently activated to be turned off (aborted). The LED indicator of a zone will begin to flash. Press the button again to advance the flashing zone until the desired zone indicator is blinking. When you have selected the desired zone, wait for a moment for the LED to stop blinking and remain illuminated. When the LED is steady, the zone will turn on for 15 minutes.

If you wish to stop the zone mid-cycle you can press the manual control button again to select another zone, or cycle it until no LED indicator lights are blinking to turn all of the zone valves off. Be aware that pressing this button while an automatic watering program is running will abort the program until the next scheduled start time. Note also that if a valve is manually turned on and remains on when an automatic program cycle is scheduled to start, the automatic program cycle will be aborted and will not run until the next scheduled start time.

5.3 XML Operation

Custom XML computer applications may be created to monitor and control the SmartStorm Irrigation Controller. This method does not use a web browser. diagnostics.xml is available for troubleshooting and system monitoring.

5.3.1 Monitoring

The state of the relays, inputs, and sensors can be monitored by sending a request to port 80 (or port specified in setup). This can be demonstrated by entering the following URL into the address bar of a web browser (substituting the IP address as necessary):

```
http://192.168.1.2/state.xml
```

The following state.xml page is returned:

```
<datavalues>
      <runMode>0</runMode>
      <zone1>0</zone1>
      <zone2>0</zone2>
      <zone3>0</zone3>
      <zone4>0</zone4>
      <zone5>0</zone5>
      <zone6>0</zone6>
      <zone7>0</zone7>
      <zone8>0</zone8>
      <zone9>0</zone9>
      <zone10>0</zone10>
      <input1state>1</input1state>
      <input2state>1</input2state>
      <units>F</units>
      <sensor1temp>x.x</sensor1temp>
      <waterBudget>100</waterBudget>
      <prgmsRunning>0</prgmsRunning>
      <serialNumber>SmartStorm Serial Number</serialNumber>
      <time>1424951320</time>
</datavalues>
```

The numbers enclosed by the tags, `<tag>`, indicate the current state or value monitored by the SmartStorm. Values for each tag are described in the table below.

XML computer applications will open a TCP/IP socket with the SmartStorm and send a `GET` command followed by the state.xml command string

XML Tags*	Monitor Values	Control Values
<runMode>	0 = ***OFF*** 1 = ***Automatic***	0 = ***OFF*** 1 = ***Automatic***
<zoneX>	The amount of time in seconds that the zone has until it is done running. 0 = Zone ***OFF***	0 = Turn zone ***OFF*** # = Turn zone on for ***x*** minutes
<inputXstate>	0 = Input ***ON*** 1 = Input ***OFF***	n/a
<units>	F = ***Fahrenheit*** C = ***Celsius***	n/a
<sensor1temp>	x.x = Indicates that no digital temperature sensor is attached. 77.3 = Current temperature.	n/a
<waterBudget>	Percent water budget that the SmartStorm is using. -1 or -2 if a digital input has stopped the program -3 if low temperature has stopped the program	n/a
<prgmsRunning>	4 bit number converted to decimal to determine which programs are running.	advanceX = 1 stopX = 1
<serialNumber>	00:00:00:00:00:00, serial number of the SmartStorm.	n/a
<time>	1253030401 = Time displayed in “epoch time” (number of seconds since January 1, 1970)	n/a

* 'X' is replaced by the zone number or input number.

5.3.2 Control

zoneXState commands can be sent to the SmartStorm to control the zones. X is replaced by 1 for Zone 1, 2 for Zone 2, and so forth. The following are a few examples:

Command	Description
state.xml?zone1State=0	Turn Zone 1 ***OFF***
state.xml?zone1State=10	Run Zone 1 for 10 minutes
state.xml?zone2State=0	Turn Zone 2 ***OFF***
state.xml?zone2State=20	Run Zone 2 for 20 minutes

5.3.3 Program Control

advanceX, and stopX commands can be sent to the SmartStorm to control the programs. X is replaced by 1 for Program A, 2 for Program B, and so forth. The following are a few examples:

Command	Description
state.xml?advance1=1	Turn Program A ***ON*** or advance to next zone
state.xml?stop1=1	Turn Program A ***OFF***
state.xml?advance2=1	Turn Program B ***ON*** or advance to next zone
state.xml?stop2=1	Turn Program B ***OFF***

5.3.4 Set Run Mode

rMode commands can be sent to the SmartStorm to control the programs. The following are a few examples:

Command	Description
`state.xml?rMode=1`	Set run mode to ***Automatic***
`state.xml?rMode=0`	Set run mode to ***OFF***

5.3.5 Password

If the Control Password is enabled on the SmartStorm and the state.xml page is requested through a browser, the user will be prompted for a password. If the XML request is sent from an XML application, the HTML request will need to contain the password, encoded as Base64. The following is an HTML request header without the password:

```
GET /state.xml?zone1State=10 HTTP/1.1 (Terminated w/ two \r\n.)
```

The following example adds the password:

```
GET /state.xml?zone1State=10 HTTP/1.1 (Terminated with \r\n.)
Authorization: Basic bm9uZTp3ZWJyZWxheQ==(Terminated with two \r\n.)
```

`bm9uZTp3ZWJyZWxheQ==` is the Base64 encoded version of the user “name:password,” `none:webrelay`.

A utility is provided at http://www.controlbyweb.com/encoder to encode the password. Simply type the password into the website and press 'Encode'.

Appendix A: Restoring Factory Default Settings

In the event that the IP address or passwords are forgotten, the SmartStorm Irrigation Controller may be restored to its original factory default settings.

1. Remove the AC power from the unit.
2. Use a thin, non-conductive object (such as a toothpick) to press and hold the small internal button located next to the 5-position terminal connector. A tactile feel can be detected as the button is pressed.
3. While depressing the button, apply power and wait for about 10 seconds before releasing the button. All settings will be back to the original factory defaults. log.txt and syslog.txt are retained.
4. Refer to **Section 3.1 Establishing Communications for Setup** to begin reconfiguration of the device.

Appendix B: Installing New Firmware

From time to time, updates are made to the SmartStorm Irrigation Controller firmware. The SmartStorm firmware can be updated in the field. The procedure for updating the firmware is outlined below. Please note that it is important that this procedure is followed precisely.

Requirements

The firmware update software requires a Windows PC with the .Net framework installed. The .Net framework is generally installed automatically through Windows update. To install it manually, go to the following address:

http://www.microsoft.com/downloads/details.aspx?FamilyId=333325FD-AE52-4E35-B531-508D977D32A6&displaylang=en

Select the Download button. Once you've downloaded the installation file, double click on the installation file to install the framework.

Setup

1. Download the bootloader.exe and the new firmware image from the ControlByWeb support team. Only a SmartStorm image can be installed on a SmartStorm so make sure the correct image is being downloaded.
2. bootloader.exe will connect to the SmartStorm using default IP address 192.168.1.2, not the address currently assigned to the SmartStorm. After the update, all settings will be lost and the device will return to its default IP address of 192.168.1.2.

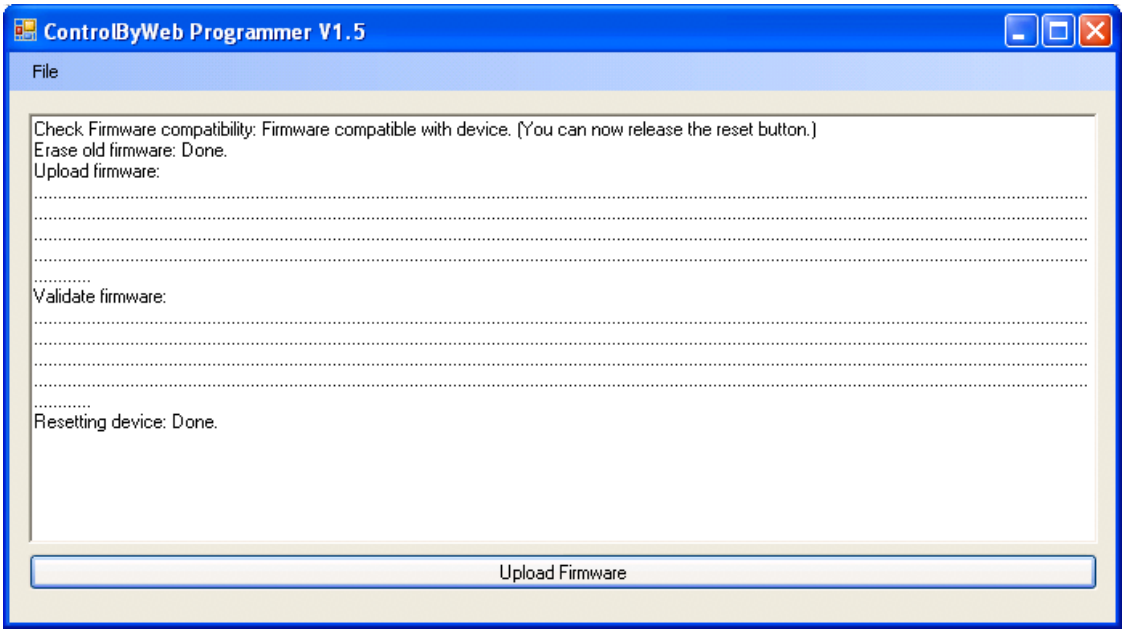
   Configure the PC to the same subnet as the IP address 192.168.1.2, such as 192.168.1.10. For instructions on doing this see section **3.1 Establishing Communications for Setup**.
3. Open the bootloader.exe utility on the computer by double clicking on the downloaded file (Figure Appendix B.1).
4. Within the cbwProgrammer utility programmer, select File, then Open. Specify the firmware image downloaded from the ControlByWeb™ support team.

Device Upgrade Procedure

Carefully follow the following steps to put the SmartStorm into bootloader mode and perform the upgrade. Make a note of the current settings. The device will be reset to factory defaults after the upgrade.

1. Remove AC power to the SmartStorm.
2. Using a small, non-conductive tool, press and hold the restore defaults button..
3. While holding the button, apply power to the SmartStorm. The Link and Act lights will flash. Continue to hold the reset button for the next step.
4. While holding the reset button, press the Upload Firmware button at the bottom of the ControlByWeb™ Programmer window. After the programming process begins, the reset button can be released
5. Programming will take approximately 20-30 seconds, the Link LED will stop flashing and remain lit. The SmartStorm will be set to factory defaults with an IP address of 192.168.1.2.

6. Refer to section **3.1 Establishing Communication for Setup** to reconfigure the SmartStorm. Verify the new version of firmware has been installed by viewing the default setup page with a web browser (http://192.168.1.2/setup.html).



Appendix C: Accessing the SmartStorm Irrigation Controller™ Over the Internet

SmartStorm Irrigation Controller™ can be monitored and/or controlled from a remote location over the Internet. Once the SmartStorm can be accessed on the local network, almost all of the settings required to provide remote access are in the router and not in the SmartStorm. This guide is not meant to be a tutorial in router setup, but rather to provide a basic overview of remote access. For specific details, the user should refer to the instruction manual for the router on the local network. Users not familiar with basic IP networking should study one or more basic IP networking tutorials before proceeding (many tutorials are available on the Internet).

IP Addresses

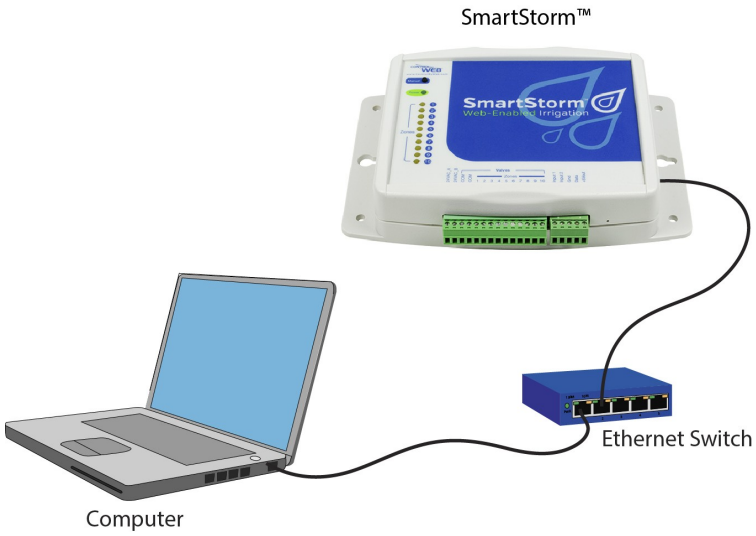
Every device on the Internet is identified by a unique address called an IP (Internet Protocol) address. IP addresses are somewhat similar to mailing addresses in that they identify the precise logical location of the device on the Internet. The IP address identifies the global region down to the network and then the specific device on that network. IP addresses are globally maintained and assigned by an entity called the Internet Assigned Numbers Authority (IANA). IP addresses consist of four numbers that range from 0 to 255 and are separated by a decimal. For example, 192.168.200.167 is an IP address.

Every device that is “directly” connected to the Internet uses a “public” IP address. The SmartStorm can be assigned a public IP address for direct connection to the Internet. Typically, a public IP address to would only be assigned to the SmartStorm when it is the only device on the local network. The IP address would be obtained from an Internet Service Provider (ISP).

Due to the limited number of public IP addresses, private networks can be set up with “private” IP addresses. These addresses are used withing a local network and have no global designation, they are not routed on the Internet. The following address blocks are designated for private networks (where x represents decimal numbers from 0 to 255): 192.168.x.x, 10.x.x.x, and 172.16.x.x - 172.31.x.x.

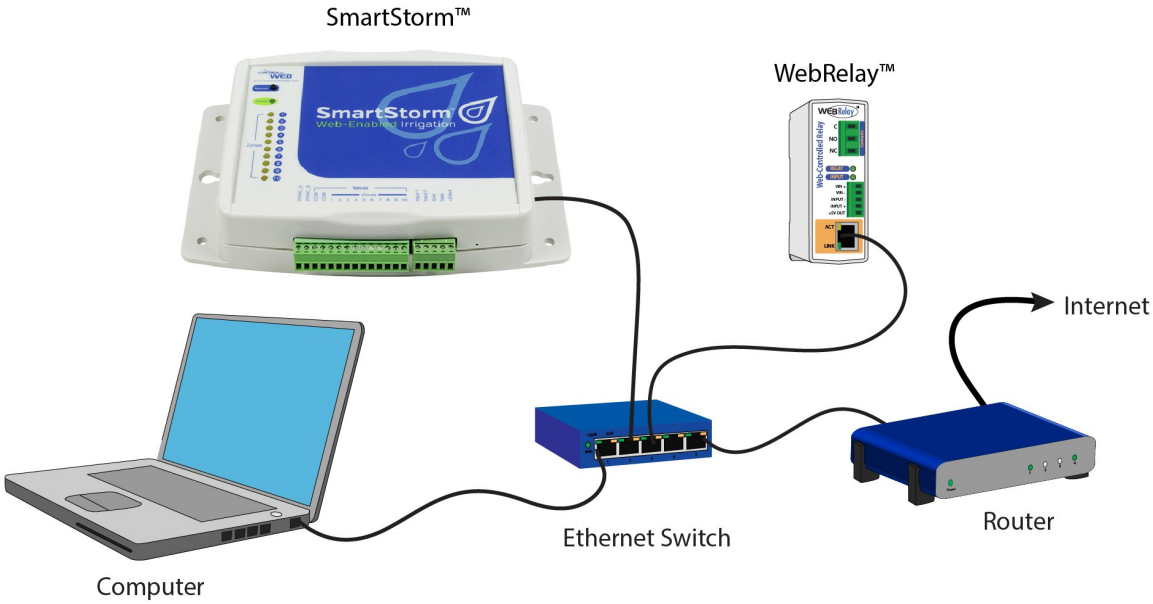
A Simple Local Area Network

A small Local Area Network (LAN), can be made up of two or more computers or other devices connected to an Ethernet switch. Each device on the network is assigned a unique private IP address. For example, consider a simple network that consists of a computer, a SmartStorm, and a WebRelay™. In this example, the computer is assigned an IP address of 192.168.1.10, The SmartStorm has the IP address of 192.168.1.25 and a WebRelay™ has and IP address of 192.168.1.26. A person using the computer can access the SmartStorm by entering its IP address in the URL line in the browser, http://192.168.1.25. Similarly, WebRelay™ can be accessed by entering its unique private IP address in the URL line in the browser, http://192.168.1.26.



A Simple LAN connected to the Internet

The LAN in the example above can be connected to the Internet by adding a router and an Internet connection. The router has two network connections. It has an Ethernet network connection to the LAN and another connection to the Internet. Often the Internet connection is called a Wide Area Network (WAN) connection. Each network connection on the router has an IP address. In our example, the IP address on the LAN side of the router has an address of 192.168.1.1. The IP address on the WAN side of the router has an IP address that has been assigned by the Internet Service Provider, such as 266.70.164.97. (This is not a valid IP address because each number cannot be larger than 255 It is used in this example for illustration purposes only.)



In the example, when a user on the computer needs to access a server on the Internet, the computer sends the request to the router at 192.168.1.1. The router sends the request to the ISP server on the Internet. The ISP server does not send the response directly to the computer on the LAN, but to the router at the IP address of 266.70.164.97. The router then forwards the response to the computer. This

way, all devices on the LAN share a single public IP address. This is called Network Address Translation (NAT).

Port Forwarding

The router can be configured to allow outside access to the SmartStorm™. All requests from the Internet to any device on the local network must use the public IP address (266.70.164.97). With only a single IP address, TCP ports are used to identify the intended device for the incoming message.

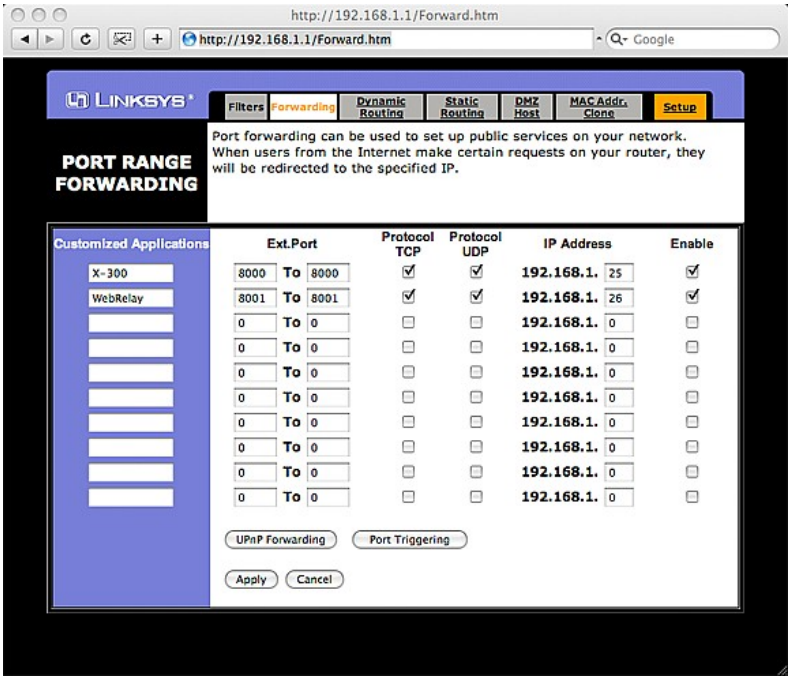
Using the mailing address analogy, the port is similar to a post office box. The IP address specifies the location, and the port specifies the specific recipient. Port numbers can be set to any number between 1 and 65235. However, many port numbers are reserved for specific applications and should be avoided. As a general rule, numbers above 8000 are safe to use. All of the ControlByWeb™ products come from the factory with the HTTP port set to 80, which is the standard port for HTTP. In this example, the SmartStorm HTTP port will be changed to port 8000 and WebRelay™ port will be changed to 8001. Once the ports are changed in the two ControlByWeb™ devices, the router must be set up for port forwarding.

Port forwarding associates the IP address of each local device with an assigned port. In this example, the address 192.168.1.25 for the SmartStorm would be associated with port 8000. The address 192.168.1.26 for WebRelay™ would be associated with port 8001. The SmartStorm would be accessed from the Internet by entering the public IP address of the router, plus the port number assigned to the SmartStorm in the URL window of the browser, http://266.70.164.97:8000. All Internet requests to the router for port 8000 would be forwarded to SmartStorm. Similarly, all request for port 8001 would be forwarded to WebRelay.

Note: When an HTTP request comes in to the router without the specific port specified (http://266.70.164.97), the router will handle this as a port 80 request (default HTTP port). In other words, http://266.70.164.97 is exactly the same as http://266.70.164.97:80.

Router configuration can vary widely. Some routers have the capability of translating the addresses and the ports, which would require no port configuration change on the WebRelay. For example, the router would be configured so that messages sent to http://266.70.164.97:8000 would be forwarded to http://266.70.164.97:80, which is the default HTTP port.

An example screen shot of a router configuration is given below. This setup allows the two ControlByWeb™ products in the above example to be accessed remotely from the Internet.



Note: *This image is an example of a typical router setup page. Routers will vary.*

Accessing Setup Pages

After changing ports, the setup pages are accessed on a local network as described below:

```
http://(Local IP Address):(Port Number)/setup.html
```

For example, to access the SmartStorm at the setup page above, the following command would be used:

```
http://192.168.1.25:8000/setup.html
```

To access the ControlByWeb™ units from the Internet, enter the public IP address of the router plus the port number of the desired device in the following format:

```
http://(Public IP Address of Router):(Port Number of Device)/setup.html
```

Using the example above, the following line would be used to access the setup page of the SmartStorm:

```
http://266.70.164.97:8000/setup.html
```

Appendix D: Log Files

The SmartStorm logs information to two different log files; log.txt and syslog.txt. Both log files are text files and are stored in nonvolatile memory; this data will not be lost due to power failure and is also not cleared when restoring factory defaults. The log files are stored in circular buffers which write from the beginning of the allocated memory space to the end and then repeat from the beginning (over-writing the original data). The nonvolatile memory is divided into 4K byte sectors. Each time data gets erased to make room for new data, a full sector (4K bytes) is erased at one time.

Data Log File – log.txt

This log file is user-configurable under the **Logging** setup tab, see section **4.6 Logging Tab** for more information. and stores real-world data such as temperatures and events such as zone changes. It can be up to 512K bytes long and is stored using a comma separated value formatting scheme.

The file is read by requesting the log.txt file from the SmartStorm. For example, using the default IP address the following command would be used to request the log file:

```
http://192.168.1.2/log.txt
```

File Format:

```
MM/DD/YYYY HH:MM:SS,Input 1,Input 2,Zone 1,Zone 2,...,Zone 10,Temperature,
Source
```

Date and Time Format:

MM – Month (1-12)
DD – Day (1-31)
YYYY – Year (1970-2106)
HH – Hour in 24 hour time (0-23)
MM – Minutes (0-59)
SS – Seconds (0-59)

Sample File:

```
Date Time,I1,I2,S1,S2,S3,S4,S5,S6,S7,S8,S9,S10,T,Source
02/24/2015 14:10:36,0,0,0,0,0,0,0,0,0,0,0,0,075.0,InpAdvCyc:(02)
02/24/2015 14:10:36,0,0,0,0,0,0,0,0,0,0,1,0,075.0,MValveON:(01)
02/24/2015 14:10:36,0,0,1,0,0,0,0,0,0,0,1,0,075.0,StnON:(MANUAL,01)
02/24/2015 14:11:03,0,0,1,0,0,0,0,0,0,0,0,0,075.1,MValveOFF:(01)
02/24/2015 14:11:03,0,0,0,0,0,0,0,0,0,0,0,0,075.1,StnOFF:(MANUAL,01)
```

The file can then be saved using the 'Save As...' option under the 'File' menu of the web browser. If the TCP port has been changed (not port 80), the port will be required to read the file. For example, using the default IP address, and port 8000, the log file would be read as follows:

```
http://192.168.1.2:8000/log.txt
```

The log.txt file may be erased with the following command:

```
http://192.168.1.2/log.txt?erase=1
```

After erasing the file, it might be necessary to refresh the page.

Note: *If the Control Password is enabled in the setup pages, the password will be required to access the log file.*

System Log File – syslog.txt

The syslog.txt file records various system events, which can be used for diagnostics and troubleshooting purposes.

File Format:

```
MM/DD/YYYY HH:MM:SS, (category to which message applies): (message)
```

Sample File:

```
01/02/2015 04:08:13 DEVICE: Power Up.
01/01/2015 00:41:05 DEVICE: Reset factory defaults.
```

Listed below is a description of messages that a user may see:

Category	Message	Description
DEVICE	Power Up	Device has been properly powered.
	Initialize	Device is ready.
	Reset Factory Defaults	Device has been reset to factory defaults.
CLOCK	RTC Reset	Real Time Clock has been reset.
NTP SERVER	Request Attempt	Device attempting to connect to NTP Server
	Failed DNS Lookup	Unable to lookup NTP server name due to an incorrect DNS setting.
	Success	Device successfully connected to NTP Server.
REMOTE SERVER	Failed DNS Lookup	Unable to lookup Remote Server due to an incorrect DNS setting.
	Connection Attempt Started	Connection port with Remote Server has been opened.
	Connection Closed	Connection port with the Remote Server has been closed.
DHCP	Address Acquired	IP address request successful, and IP address assigned.
	Lease Renewal	IP address assigned to device was renewed.
MAIN_MCU	New Firmware Loaded	New firmware has been loaded to the device.

This file is read by requesting the syslog.txt file. For example, using the default IP address the following command would be used:

```
http://192.168.1.2/syslog.txt
```

Note: *The setup user name and password are required to access this file.*

If the TCP port has been changed (not port 80), the port will be required to read the file. For example, using the default IP address, and port 8000, the log file would be read as follows:

```
http://192.168.1.2:8000/syslog.txt
```

To erase the file, use:

```
http://192.168.1.2/syslog.txt?erase=1
```

Appendix E: External Server and Remote Services

Note: *The following methods are supported by the SmartStorm; however, Xytronix Research & Design, Inc. does not provide or support custom third party applications, or external web servers.*

Accessing the SmartStorm Irrigation Controller with Custom Software or Third Party Applications

Custom applications can send commands to the SmartStorm for monitoring and control. The application interface can be used to provide a custom user interface, access to multiple units in a single screen, and allow for automation, logging, and other application-specific features.

Using an External Web Server

Rather than accessing the SmartStorm directly from a computer, an external web server can be used. The term “external” web server is used here to mean a separate web server (such as Apache or IIS) that is not the web server built into the SmartStorm. In this scenario, users access custom web pages that reside on the external web server and the external web server communicates with the SmartStorm.

An external web server can integrate multiple ControlByWeb products into a single control page. In other words, the user may not be aware that he/she is using multiple ControlByWeb™ devices, but rather the user sees an integrated control page for the entire system. In addition, the use of an external web server allows programmers to create custom user interfaces that take advantage of the additional resources typically available on larger web servers, including more memory and various web programming languages.

There are two approaches that an external server can use to communicate with the SmartStorm and other ControlByWeb™ devices, Direct Server Control and Remote Services.

Direct Server Control

The first approach is for the external server to create a TCP connection whenever it needs to access the SmartStorm. In this case, the external server opens the connection, sends commands and/or reads the device, and closes the connection.

This method is ideal when the web server and all of the SmartStorm devices are on the same network (without routers between them). In this case, the server can communicate with the SmartStorm devices directly and securely since data never has to leave the local network.

When the server and a SmartStorm are on different networks, routers must be configured to allow appropriate access. If a public network is used, such as the Internet, security precautions should be considered.

Remote Services

The second approach is for the SmartStorm to initiate a connection using the “Remote Services.” The settings under the **Advanced Network** tab in the setup pages will enable the SmartStorm to open a TCP connection with an external server. Once the connection is open, the external server can send commands and/or read the device. The external server can leave the connection open (so that it never closes) or close the connection.

“Remote Services” is ideal for installations where the server and a SmartStorm are installed on different networks. This is especially useful when each SmartStorm is installed on a separate private network. For example, if the user doesn't control the network connections where the SmartStorm is installed, “Remote Services” would initiate a TCP connection over the Internet with the control computer. Since the SmartStorm initiates the connection, the control computer doesn't have to know the IP address of the SmartStorm. This means that the SmartStorm can be installed using DHCP. In addition, no special router configuration is required. This makes the network installation of the SmartStorm very simple, and

since no incoming ports need to be opened in the router, security is not compromised. See section **4.3 Advanced Network Tab** for more information.

The SmartStorm can be configured to establish a connection when triggered by an event, such as a relay state changing. This is done by setting the Remote Service/SNMP checkbox in the relay and input setup tabs.

Connection String

With Remote Services enabled, a connection attempt will be made periodically according to the Connection Interval setting in the **Advanced Network** setup tab. The Connection String is a user-defined character string configured in the **Advanced Network** tab.

The connection string is also sent at the same interval once the connection is open. The external server is responsible for closing the connection when it is done.

Remote Commands

Once the connection is open, the remote server can issue HTTP GET requests to the device for XML files.

Request about.html:

```
GET /about.html HTTP/1.1\r\n\r\n
```

Turn Zone 1 ON for 10 minutes:

```
GET /state.xml?zone1State=10 HTTP/1.1\r\n\r\n
```

Appendix F: Specifications

Operating Specifications

Programming:	Easy to use web page setup and operation Zones can be named, programs are displayed in chart format
Number of zones:	10 (two zones can be individually programmed as a master valve or pump)
Station timing:	4 individual programs (A, B, C, D), 1-minute increments up to 254 minutes/station, programmable delay between stations
Start Time:	8 for each program
Programming Schedule:	Odd day, even day, day of week, variable day cycle
Monthly Water Budget::	0 – 100% for each calendar month
Shutdown:	With low temperature or rain
Logging:	Temperature and schedule events are logged to non-volatile memory

Electrical Specifications

Input Voltage:	24VAC ±10%, 60Hz
Input Current:	125mA typ (10Mbps), 180mA typ (100Mbps), plus zone valves
Zone Load Capacity:	Up to two 24VAC, 7VA solenoid valves or one 24VAC, 7VA solenoid valve plus a master valve or pump start relay
Internal Fuse:	1.5Amp, 3AG (¼ x 1-1/4")
Protection:	AC input and each zone output is protected with an internal MOV (metal oxide varistor) over voltage surge protection device
Program Storage:	Nonvolatile memory

Ethernet

10 Base-T or 100 Base-T, 8-pin RJ-45 Ethernet

Network

Ethernet IPv4, Static IP address or DHCP
Supports Web Browser (HTTP) and XML
Remote services – can be controlled and monitored from an external web server

Real-Time Clock

Manual or NTP (Network Time Protocol) setup, NTP Sync configurable for periodic update
Automatic daylight savings adjustment
Battery backup via internal super capacitor, 30 days minimum
Accuracy ±1-minute/month

Removable Connectors:

Zones:	14-position, 3.81mm (Phoenix P/N 1803691)
Sensor Input:	5-position, 3.81mm (Phoenix P/N 1803604)

Connector Specifications:

Type:	14-position and 5-position, removable, 3.81 mm pitch
Connection wire:	Use wire rated for 75ºC (min) for connections to the terminal blocks
Stripping Length:	7mm
Connection capacity:	1.5mm^2 stranded, 1.5mm^2 solid
Conductor minimum:	30AWG (UL/CUL)
Conductor maximum:	14 AWG (UL/CUL)
Conductor Type:	Copper
Tightening torque:	0.22 Nm (min), 0.25 Nm (max)

Pushbutton & LED Indicators

Pushbutton:	Manually select and activate a specific zone (plus pump if enabled)
Green:	Power On
Yellow:	Zone 1 thru 10
Ethernet:	Green = Linked, Yellow = Activity

Sensor Inputs

Digital Inputs:	Two, programmable, rain delay or manual operation Vin Max = +5.0V, Internal pullup = 47K Vin HI = 2.8V (min), Vin LO =1.0V (max) Max cable length 50 ft (use relay isolation for longer runs)
Temperature Sensor:	Dallas Semiconductor DS18B20 digital 1-wire thermometer Accuracy: +/-0.5°C (-10°C to +85°C) Maximum cable length 600 ft (180m)

Environmental

Location:	Indoor use or NEMA-4 protected location
Operating Temperature:	-40ºC to 65ºC (-40ºF to 150ºF)
Storage Temperature:	-40ºC to 85ºC (-40ºF to 185ºF)
Humidity:	5-95%, non-condensing

Mechanical

Mounting:	Wall mount
Material	Polycarbonate plastic
Size:	7.56 x 5.06 x 1.54 in. (192.14 x 128.64 x 39.24mm) not including connector
Weight:	12.3 oz (348.7 g)

Electromagnetic Compliance

IEC CISPR 22, CISPR 24
FCC 47CFR15 (Class B)
EN55024 ITE Immunity (2010)
EN55022 Emissions (2010)

CE

Appendix G: Trademark and Copyright Information

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Appendix H: Warranty

This Xytronix Research & Design, Inc. product has a warranty against defects in material and workmanship for a period of one year from the date of shipment. During the warranty period, Xytronix Research & Design, Inc. will, at its option, either repair or replace products that prove to be defective. This warranty is extended to the original purchaser of the equipment only.

For warranty service or repair, the product must be properly packaged, and returned to Xytronix Research & Design, Inc. The purchaser shall prepay all charges for shipping to Xytronix Research & Design, Inc., and Xytronix Research & Design, Inc. will pay the shipping charges to return the product to the purchaser as long as the product is shipped within the United States. If the product is shipped outside of the United States, the purchaser shall pay all shipping charges, duties, and taxes.

Limitation

The foregoing warranty shall not apply to defects or damage resulting from improper use or misuse, unauthorized repair, tampering, modification, improper connection, or operation outside the electrical/environmental specifications for the product. Further, the warranty does not cover Acts of God, such as fire, flood, hurricanes, and tornadoes. This warranty does not cover damage to property, equipment, direct, indirect, consequential, or incidental damage (including damage for loss of business profit, business interruption, loss of data, and the like) arising out of the use or misuse of this product.

UNDER NO CIRCUMSTANCES WILL THE LIABILITY OF XYTRONIX RESEARCH & DESIGN, INC. TO THE PURCHASER OR ANY OTHER PARTY EXCEED THE ORIGINAL PURCHASE PRICE OF THE PRODUCT, REGARDLESS OF THE FORM OF THE CLAIM. No other warranty is expressed or implied. Xytronix Research & Design, Inc. specifically disclaims the implied warranties or merchantability and fitness for a particular purpose. Some jurisdictions may not allow the exclusion of limitation of liability for consequential or incidental damage.

Appendix I: FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Warning

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause interference to radio communications. There is no guarantee, however, that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into a relay on a circuit different from where the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Notice

Changes or modification not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Appendix J: Mechanical Dimensions